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A. P. I. Convention Number

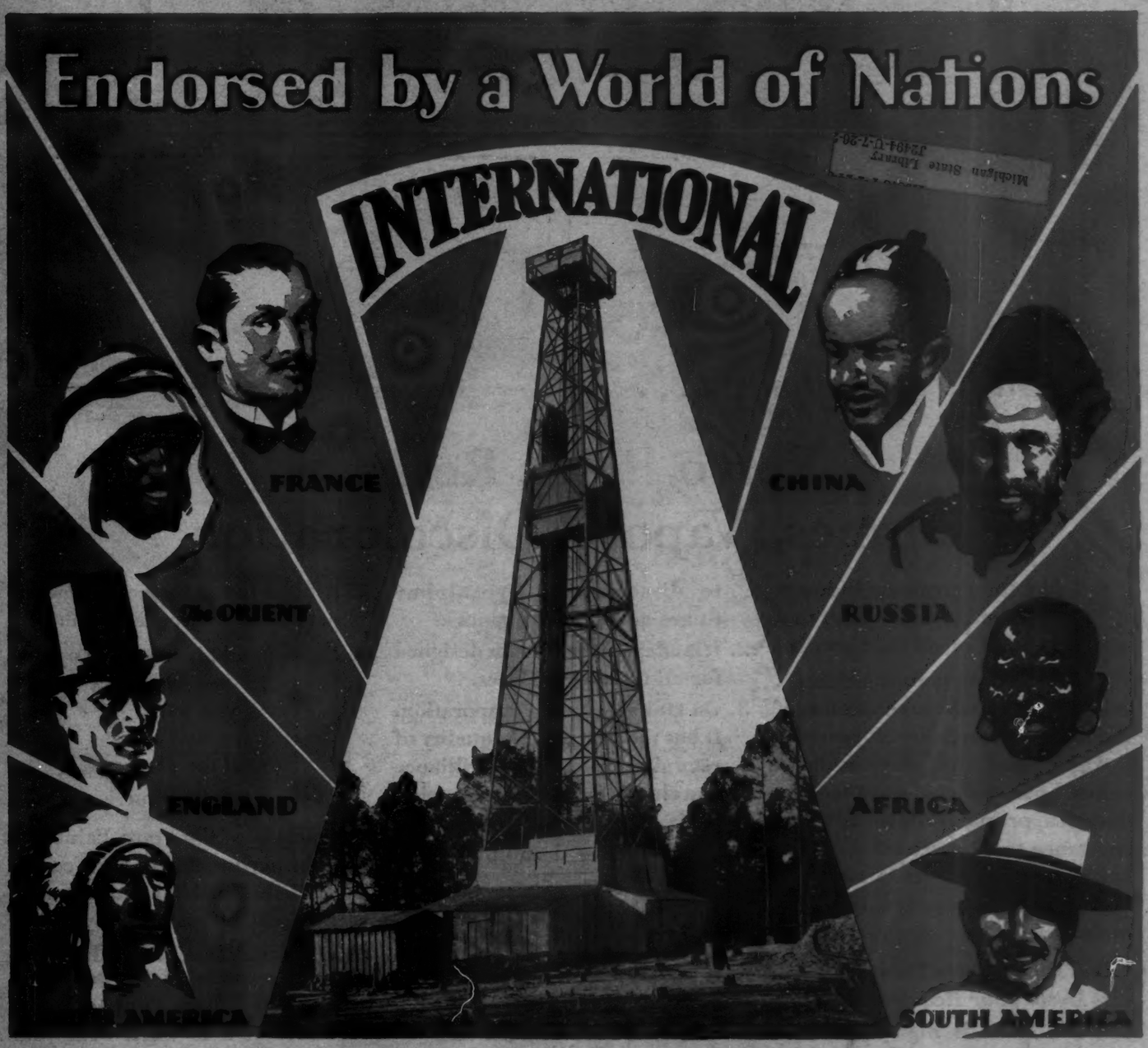
15 Cents

The OIL and GAS JOURNAL

PRODUCING REFINING ENGINEERING MARKETING

Published Every Thursday TULSA, OKLAHOMA, DECEMBER 5, 1929 $6.00 a Year

Endorsed by a World of Nations



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THE INTERNATIONAL DERRICK & EQUIPMENT CO., Columbus, Ohio—Los Angeles, Cal.

Plants: Columbus, Delaware, Ohio; Houston, Beaumont, Texas; Torrance, California. *Sales Offices:* Columbus, Ohio; New York City, N. Y.; Detroit, Michigan; Tulsa, Oklahoma; Fort Worth, Houston, Texas; Shreveport, Louisiana; Wichita, Kansas; Denver, Colorado; Los Angeles, California; Maracaibo, Venezuela. *Warehouses and Yards:* Columbus, Ohio; Tulsa, Seminole, Tonkawa, Maud, Sasakwa, Allen, Oklahoma City, Oil City, Oklahoma; Wichita, Wichita Heights, Kansas; Bakersfield, Torrance, California; Houston, Big Spring, Odessa, Pyote, Borger, Mexia, Luling, Grand Saline, Texas; Shreveport, Lake Charles, Louisiana; El Dorado, Smackover, Arkansas.

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On Tanks and Buildings . . . on all Oil-Field Equipment . . .

Petro Paint Resists Fumes, Vapors, Discoloration

AT last, the Petroleum Industry has found a utility paint that stands the gaff of oil field service!

Petro Paint stands up amazingly, even under the severe conditions of the field or the refinery. It provides a white paint that *stays* white—colored paints that do not fade or darken appreciably. Its remarkable resistance to all destructive factors brings efficiency in upkeep—substantial economies in paint maintenance.

Here's Why Petro Paint Exactly Meets Your Requirements

1. Petro Paint is highly resistant to discoloration by sulphur fumes and aqueous vapors.
2. It is adapted for systems designed for all types of surfaces.
3. On tanks it curtails evaporation. It has the remarkable quality of retaining its original brilliance and cleanliness for a long period of time without fading.
4. It has greater durability under all conditions.
5. It leaves a good surface for repainting.
6. It can be applied under adverse temperature conditions. It does not crawl on cold surfaces.
7. It hides better than other mixed paints—is very economical.
8. Petro Paint gives you an opportunity to use color effectively wherever you wish.

Send for further information

Full details of the Petro Paint line have been compiled in our Technical Bulletin No. 4. At your request, a copy will be mailed to you immediately. Or, if your problem requires a special study, we will be glad to send a du Pont technical representative to work with you.

DU PONT
REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., *Incorporated*

Petroleum Sales Department OJ-12

INDEPENDENCE SQUARE PHILADELPHIA, PA.

Chicago, Ill. **San Francisco, Cal.**

ALL OVER THE LOT *in the* OIL COUNTRY

. . . *and under it too*

1000 Pound Test
Double Disc Gate Valve

A steeliron valve heavily built to stand piping and temperature strains on oil and gas lines.

You find Walworth all over the lot in the oil country . . . Walworth jobs and Walworth jobbers pepper the map from the Gulf to the Pacific Coast.

Why? Because, in the first place, Walworth valves, fittings and tools are made by men who know exactly what you need and why you need it.

Because the Walworth line is not only *complete* in all temperatures and pressure ratings in iron, bronze and steel, but *standardized* in the sense that each individual Walworth product has been designed to fit in as a part of an all-Walworth installation.

And, in the manufacturing process, wherever a test or an inspection can be applied to assure you of greater safety and better service, you can be sure that Walworth will apply it before your order is allowed to be shipped.

WALWORTH

Walworth Company, General Sales Offices: 51 E. 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa.; and Attalla, Ala.

. . . Distributors in Principal Cities of the World . . .
Walworth Company Limited, 620 Cathcart St., Montreal, P. Q.
Walworth International Co., 11 Broadway, New York, Foreign Representative

The Oil and Gas Journal, issued weekly by The Petroleum Publishing Company, 114-116 West Second Street, Tulsa, Oklahoma. Subscription price $6.00 a year; 15 cents a copy. Entered as second-class mail matter December 15, 1911, at the post office at Tulsa, Okla., under the Act of March 3, 1879.

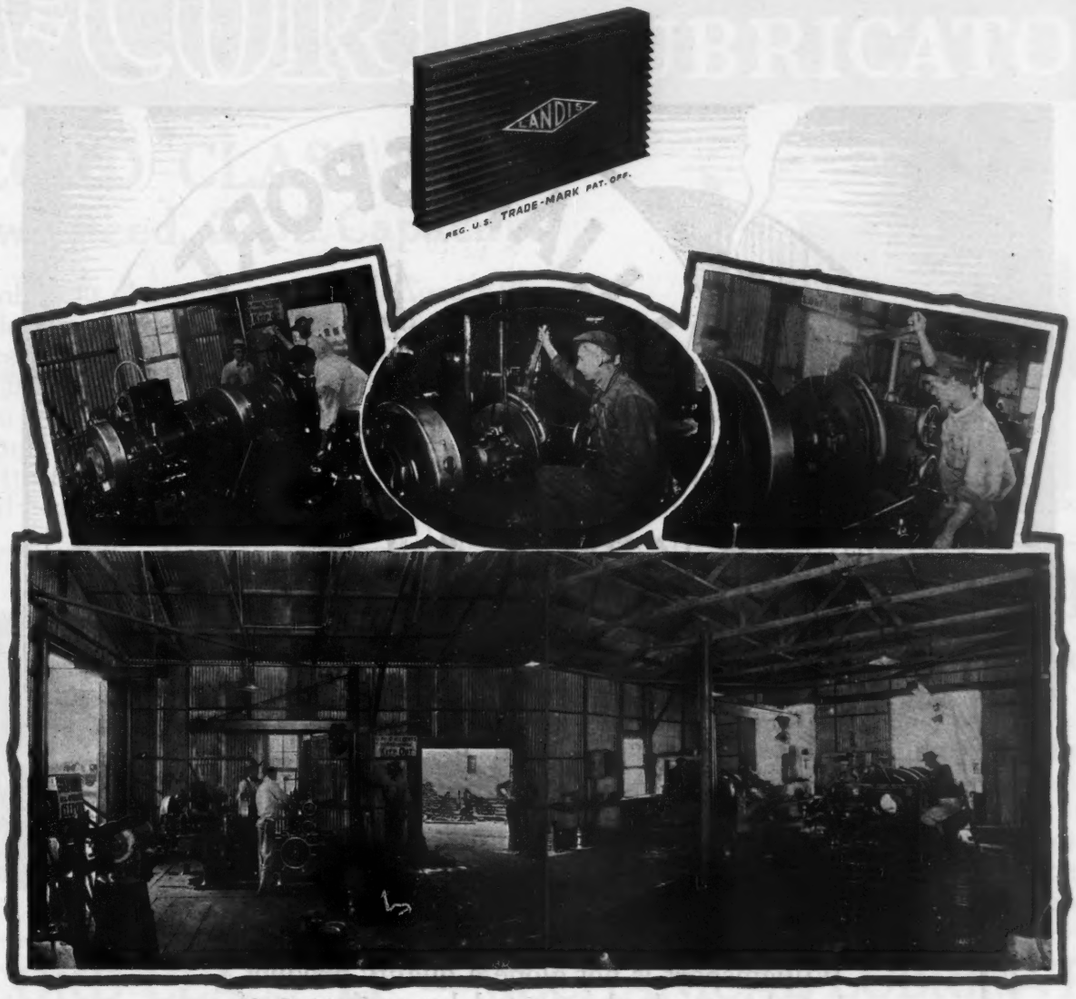
A BANK'S FIELD OF SERVICE MUST BE BROAD

There have been no progressive undertakings involving the Southwest in which the First National Bank and Trust Company has not been vitally active. This institution has held consconsistently to the viewpoint that in business, commerce, industry and public life banks that render distinctive service forge ahead like individuals . . . on merit. History has established the First National as one of the most solidly progressive banks in the southwest . . . a banking establishment big enough for any banking task.

THE FIRST NATIONAL BANK AND TRUST COMPANY

TULSA OKLAHOMA

Resources Exceed $45,000,000



There is a reason why so many fine shops, such as that of the Sinclair Oil and Gas Company in the Bowlegs Pool, are *completely* Landis equipped.

The reason is not hard to find—the Landis Pipe Threading and Cutting Machine meets *all* oil field requirements *more fully.*

Landis machines always produce threads to the A.P.I. specifications — well formed, cleanly cut, correctly tapered threads. They are powerful and sturdy in construction to withstand high operating speeds and heavy duty, and they are flexible in permitting quick set-up changes.

The decidedly low operating cost—insured by the Landis chaser—added to these facts unquestionably establish the superiority of the Landis Pipe Threading and Cutting Machine.

A Landis in your shop will do a better job at a lower cost.

Catalog No. 31 will be sent upon request.

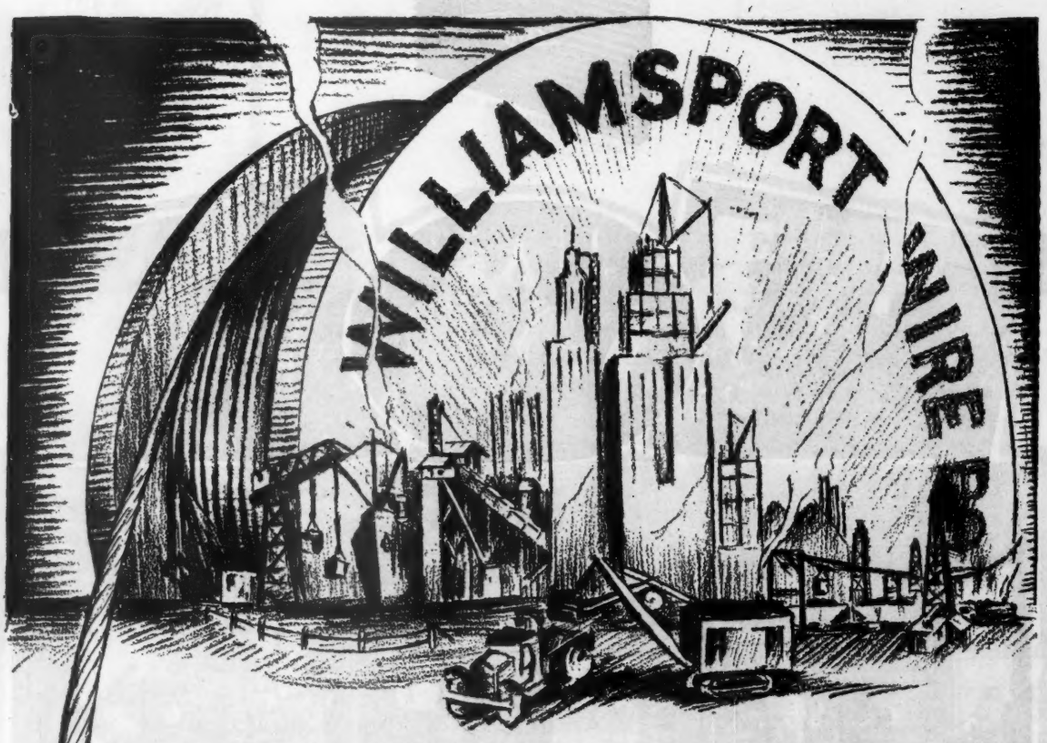
LANDIS MACHINE COMPANY, Inc.,

Waynesboro, Pa., U. S. A.

Detroit Office—5928 Second Blvd.

Cleveland Office—504-505 Marshall Bldg.

REPRESENTED IN THE DOMESTIC OIL FIELDS BY: Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; D. S. Mair Machinery Co., Houston, Tex.; Woodward, Wight & Co., New Orleans, La.; Herberts Machinery & Supply Co., Los Angeles, Calif.; Herberts Moore Machinery Co., San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.



Be sure you use outstanding quality when selecting a

WIRE LINE

Williamsport is not alone a quality product, but the standard accepted by engineers of authority in every active field.

You'll find Williamsport lines near you for quick service and men capable of giving intelligent advice concerning them.

Use Williamsport for Better Results

WILLIAMSPORT WIRE ROPE COMPANY

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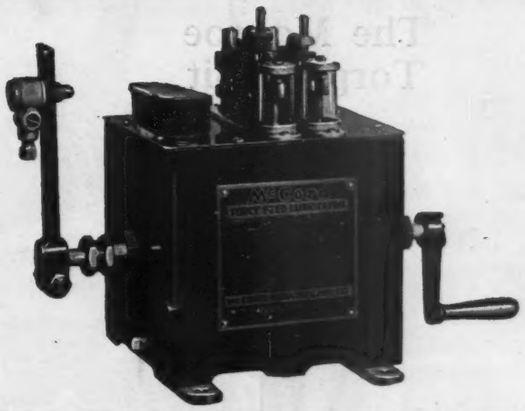
Distributed by the Bridgeport Machine Company, Wichita, Kansas, and all of their Mid-Continent Branches.

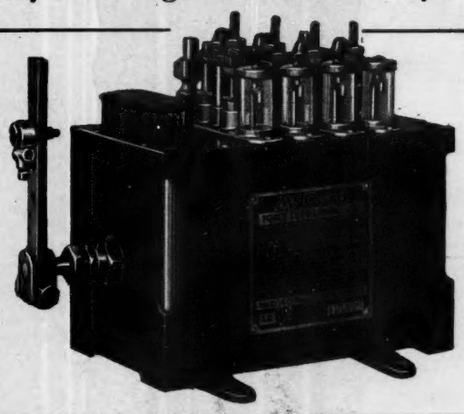
The Largest Exclusive Wire Rope Plant in America

McCORD FORCE FEED LUBRICATORS

McCORD CLASS "LD"—
Two Feed, 2 Qt. Capacity

It's an inherent characteristic of McCord Lubricators to deliver minute quantities of oil against high pressures. The pumping units can be adjusted to deliver quantities of oil varying from a fraction of a drop to a constant stream. Adjustments once made remain unchanged. They are not affected by extreme temperature changes. They deliver the same quantity of oil regardless of viscosity.





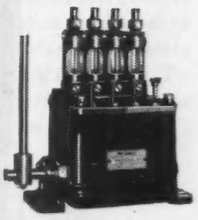
McCORD CLASS "LD"—
Four Feed, 1 Gal. Capacity

A McCord Lubricator is the only one of its kind that shows the oil actually being delivered to the cylinder or part being lubricated. Another safeguard that makes for dependable service is that undetected leakage is impossible. The construction of McCord Lubricators makes immediately evident any leaks since oil will accumulate on top of the reservoir.

McCORD CLASS "LF"—MECHANICAL LUBRICATORS

A McCord Class "LF" Mechanical Lubricator installed on your pipe line engines assures uninterrupted and absolutely uniform delivery of oil to power and compressor cylinders irrespective of temperature, pressure, or rate of feed; the quantity varying only with variations in speed or manual changes in adjustment.

The largest and most outstanding engine installations of the year have been 100% McCord equipped.



McCORD CLASS "LD"—
Sixteen Feed, 3 Gal. Capacity

McCord engineers will gladly co-operate and make the most satisfactory recommendations upon submission of your requirements. From one of these McCord Lubricators a unit can be selected to meet any condition or service.

McCORD RADIATOR & MFG. CO.
LUBRICATOR DIVISION
Detroit Michigan

THE HIGH COST OF PRODUCTION DEMANDS
The use of
"BETTER TOOLS"

The Monroe Torpedo Bit

Patent applied for.

Will positively drill a straight, round hole, free from deflection so often caused by boulders, inclined earth strata, etc.

Easy to dress.

Will straighten the most obstinate crooked hole.

Patent applied for.

The Monroe "Talon" Friction Socket

A recent addition to the "Talon Line" family.

A series of stellited wickers spirally spaced around socket shell insures a positive hold that cannot be equalled by any thin wall or ordinary friction socket.

Descriptive matter and prices furnished on request.

The Akins Under-driller Bit

Patented.

Used where it is impossible to get casing deep enough on account of caving wall.

Drills an enlarged hole ahead of the casing. Drills and reams in one operation.

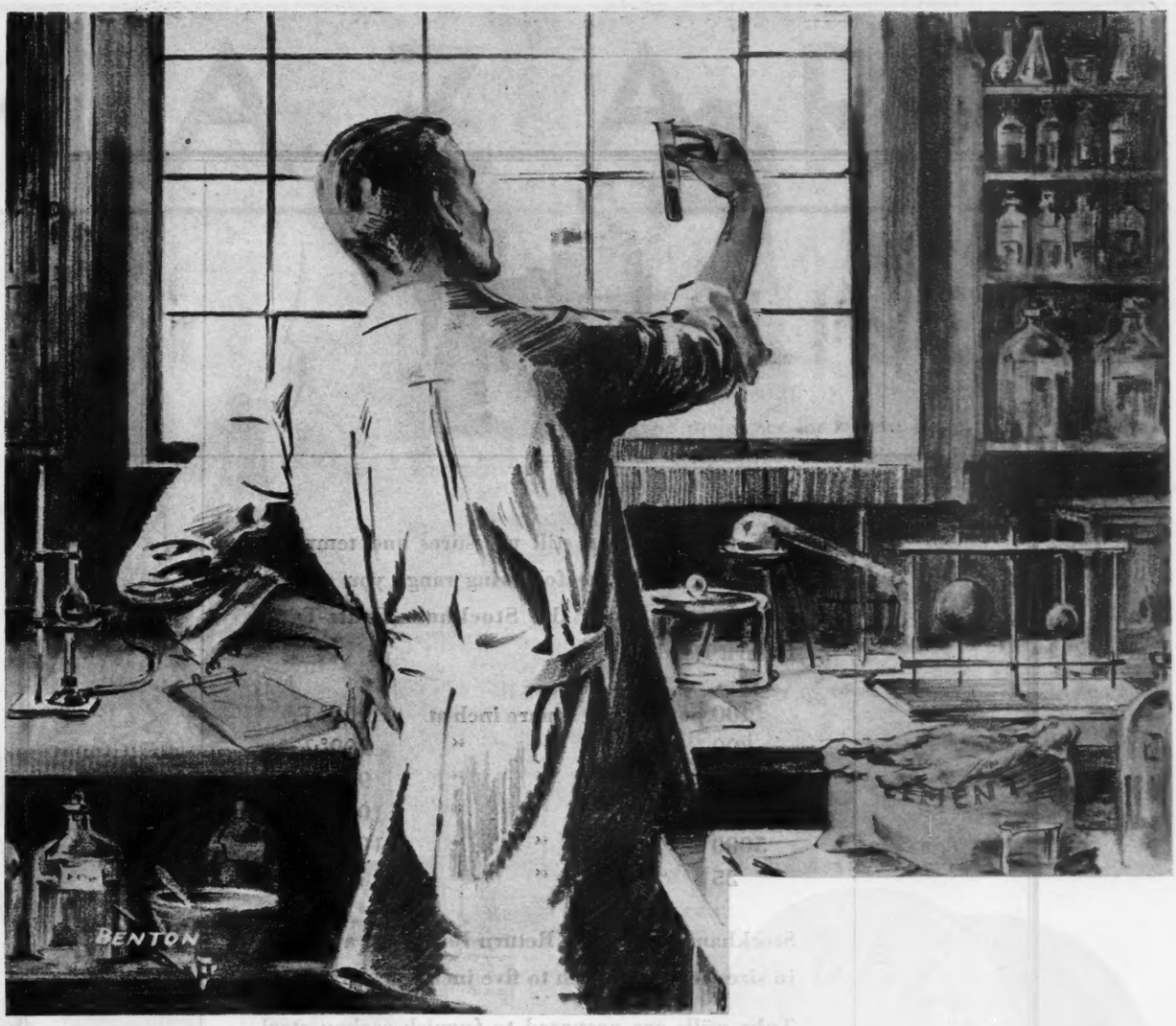
Save that expensive underreaming job.

Manufactured by

Manufacturers of the "Talon Line" Rope Tools

Cameron Tool & Supply Co.,
Cameron, West Virginia,
U. S. A.

"Use the better tool first"



At no time in its history has Halliburton failed to appreciate the *responsibilities* it assumed when it became the world's leading oil well cementing company. Halliburton chemists are constantly testing waters, experimenting with mud and fluids, co-operating with cement manufacturers. Halliburton engineers are ever at work seeking to develop and improve processes and equipment.

The price of leadership is unremitting research, everlasting vigilance. It is a price Halliburton gladly assumes.

Unusual cementing problems, general oil industry information and a dash of humor are combined in the monthly contents of THE CEMENTER. To be placed on the subscription list, sign and return the coupon today.

Halliburton Oil Well Cementing Co.
Dept. OG, Duncan, Okla.

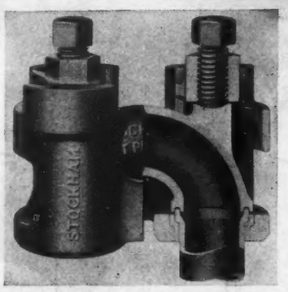
Without cost or obligation, please place my name on the list to receive THE CEMENTER regularly as issued.

Name _____

Company _____

Address _____

HALLIBURTON
OIL WELL CEMENTING CO.
Duncan, Oklahoma



IF your cracking still pressures and temperatures are within the following range you should know more about the Stockham Fantz-Type Return Bend.

400	pounds	per	square	inch at	900° F.
800	"	"	"	"	900° F.
1200	"	"	"	"	900° F.
3000	"	"	"	"	1000° F.
5000	"	"	"	"	1000° F.
25	"	"	"	"	1500° F.

Stockham Fantz-Type Return Bends are available in sizes from one inch to five inch, inclusive.

Tube mills are prepared to furnish carbon steel or alloy steel Tubes to Stockham specifications on short notice.

Inquiries will receive prompt attention

STOCKHAM PIPE & FITTINGS CO., *Birmingham, Ala.*

Boston, New York, Philadelphia, Chicago, Detroit, Houston, Los Angeles

STOCKHAM

(FANTZ-TYPE)

RETURN BEND

THERE IS A STOCKHAM FITTING FOR EVERY OIL REQUIREMENT

ELECTRIC CAST STEEL—CAST IRON—MALLEABLE

HAZARD

WIRE LINES

THE outstanding preference for Hazard Wire Line in the oil field is due to its ability to lower rope costs by materially lengthening rope life.

Strong, flexible and highly resistant to abrasion, Hazard lines assure long, economical service on every operation.

Complete stocks of Hazard Wire lines for the oil field carried at branches and distributors listed.

There's a Hazard Line for every oil country service

DRILLING LINES
FLEX-SET PRE-FORMED ROTARY LINES
CASING LINES
SUCKER ROD LINES
SAND AND MANDREL LINES
WIRE ROPE

HAZARD WIRE ROPE COMPANY
WILKES-BARRE PENNSYLVANIA

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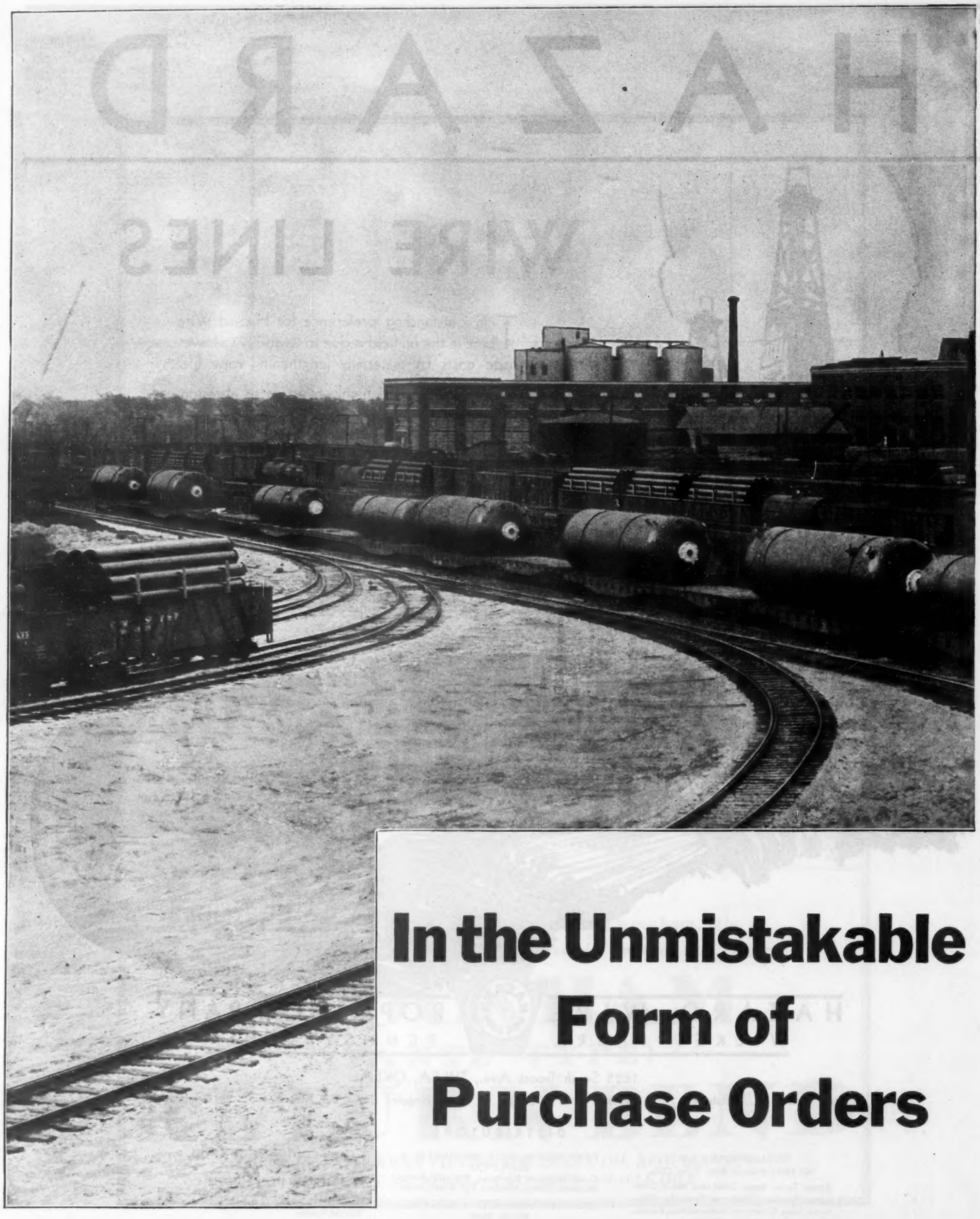
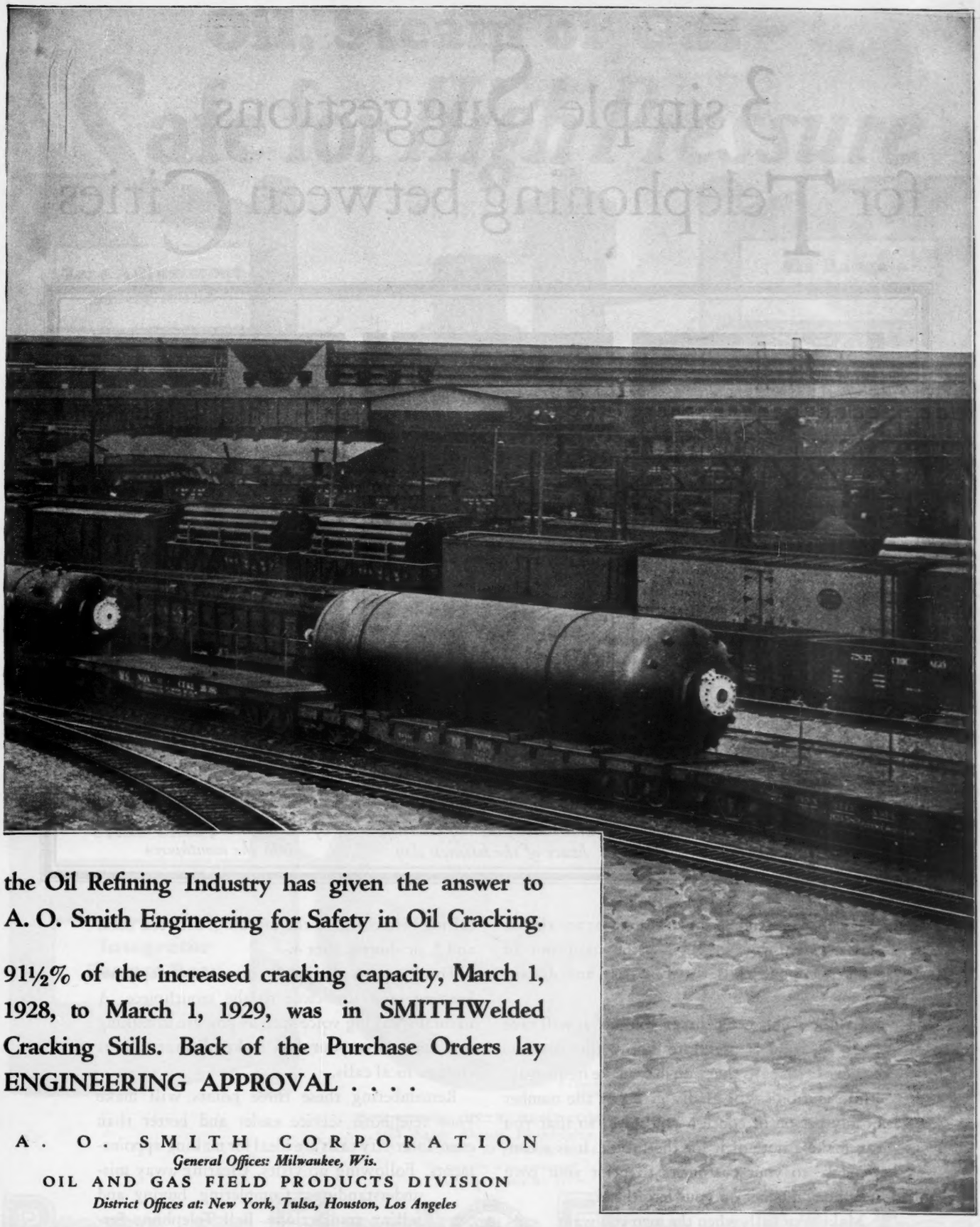


In the Unmistakable Form of Purchase Orders

SMITHWELDED



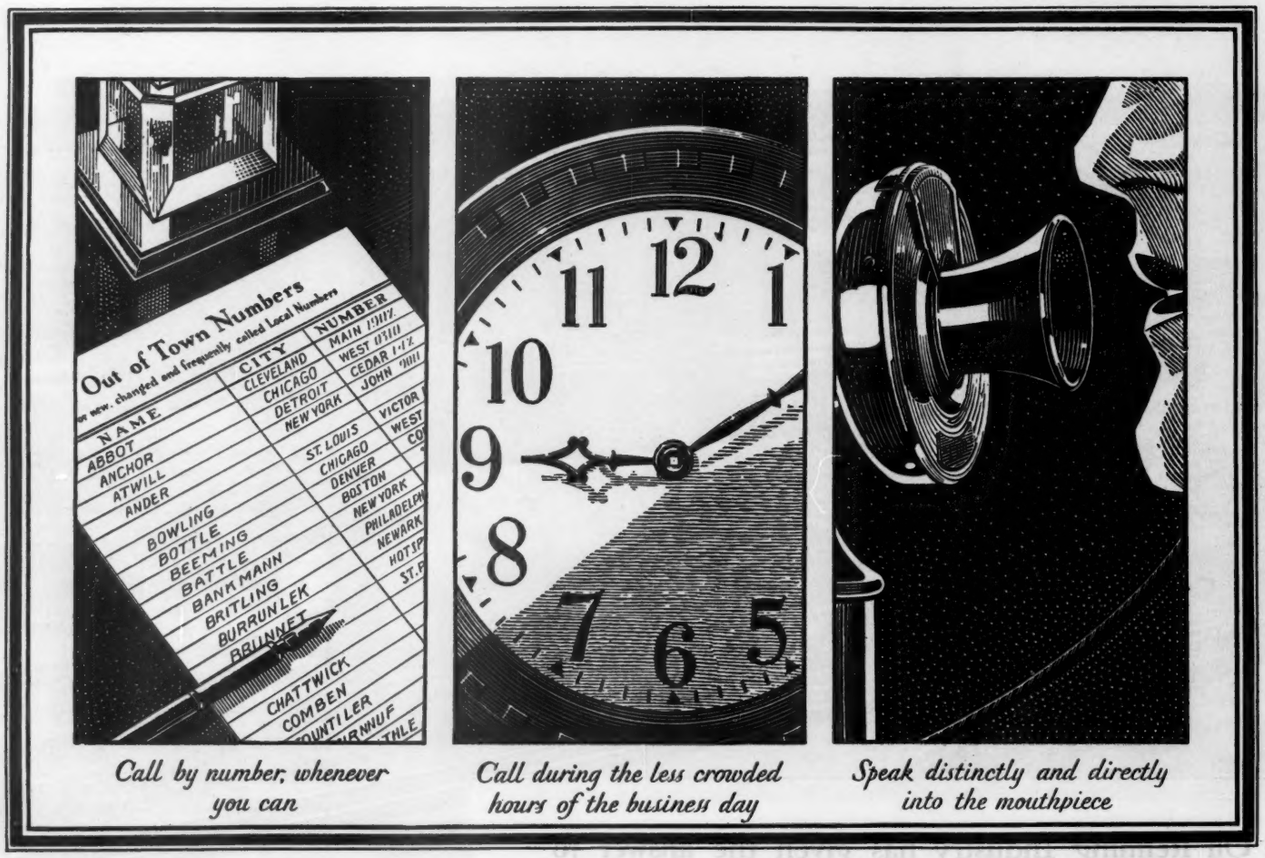
the Oil Refining Industry has given the answer to A. O. Smith Engineering for Safety in Oil Cracking.

91½% of the increased cracking capacity, March 1, 1928, to March 1, 1929, was in SMITHWelded Cracking Stills. Back of the Purchase Orders lay ENGINEERING APPROVAL . . . .

A. O. SMITH CORPORATION
General Offices: Milwaukee, Wis.
OIL AND GAS FIELD PRODUCTS DIVISION
District Offices at: New York, Tulsa, Houston, Los Angeles

CRACKING STILLS

3 simple Suggestions for Telephoning between Cities



Call by number, whenever you can

Call during the less crowded hours of the business day

Speak distinctly and directly into the mouthpiece

HERE are three simple suggestions that are almost sure to help you in getting the most out of your telephone calls between near and distant towns.

Call by number, whenever you can; it will save your time. It is useful to know the number, especially for calls that you may make frequently. "Information" will gladly give you the number of any person or concern you wish, so that you can make a note of it for the future. It is a convenience to your customers to print your own telephone number on your letterhead.

Make your calls when the men you want to reach are likely to be less busy. Try calling before 9:30 in the morning, between noon and 2, or shortly after 4.

Third, speak distinctly into the telephone, keeping your lips close to the mouthpiece. A natural speaking voice such as you use in talking to a man across your desk makes distant calls as clear as local calls.

Remembering these three points will make your telephone service easier and better than ever. Inter-city calls are ideal for making appointments. Following up visits. Clearing away misunderstandings. Completing buying and selling transactions. Bell Telephone Service is *Convenient . . . Economical . . . Universal.*

AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES — BELL SYSTEM

Oil, Steam or Gas—

Safe for *High Pressure*

Zero Adjustment Easily Made

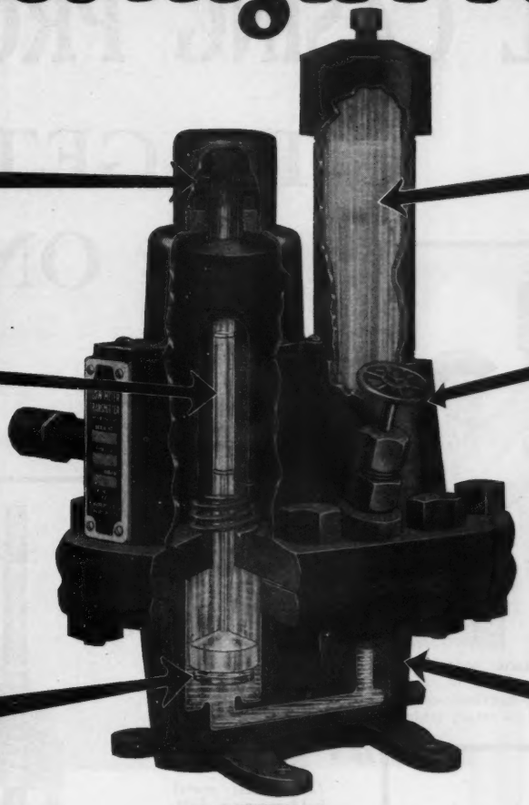
Vary Voltage No Effect

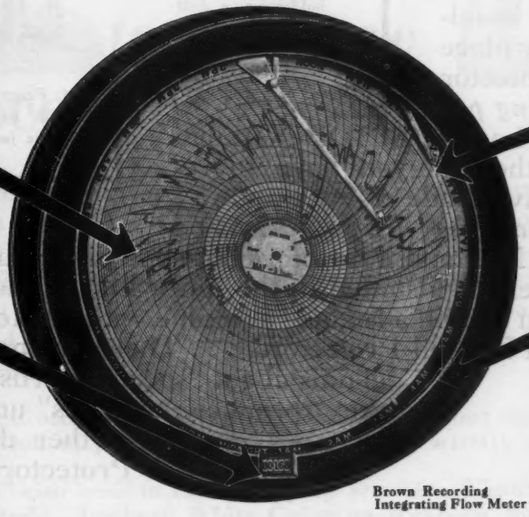
Tested to 2500 lbs. Pressure

Mercury Can't Blow Out

Legible Open Scale Chart

Integrator Easy to Read





Six Range Changes

Double Range Manometer

No Stuffing Boxes

Forged Steel Manometer

Integration Record on Chart Rim

Dust Proof Aluminum Case

Brown Recording Integrating Flow Meter

THE BROWN INSTRUMENT COMPANY
4488 Wayne Avenue, Philadelphia, Pa.
Branches in 20 principal cities
"To measure is to economize"
Write for Catalog No. 21

Brown Electric Flow Meter

on the Inductance Bridge Principle

YOU DON'T HAVE TO BURN
NATIONAL CASING PROTECTORS
TO GET THEM ON YOUR DRILL PIPE!

(1) Press rubbers over mandrel until four are in place (enough for a "stand" of drill pipe).

(2) Place tube containing rubbers over end of drill pipe and onto hydraulic ejector, mounted on rotary table.

(3) Install metal holder onto drill pipe.

(4) Pump rubber onto holder by use of hydraulic jack.

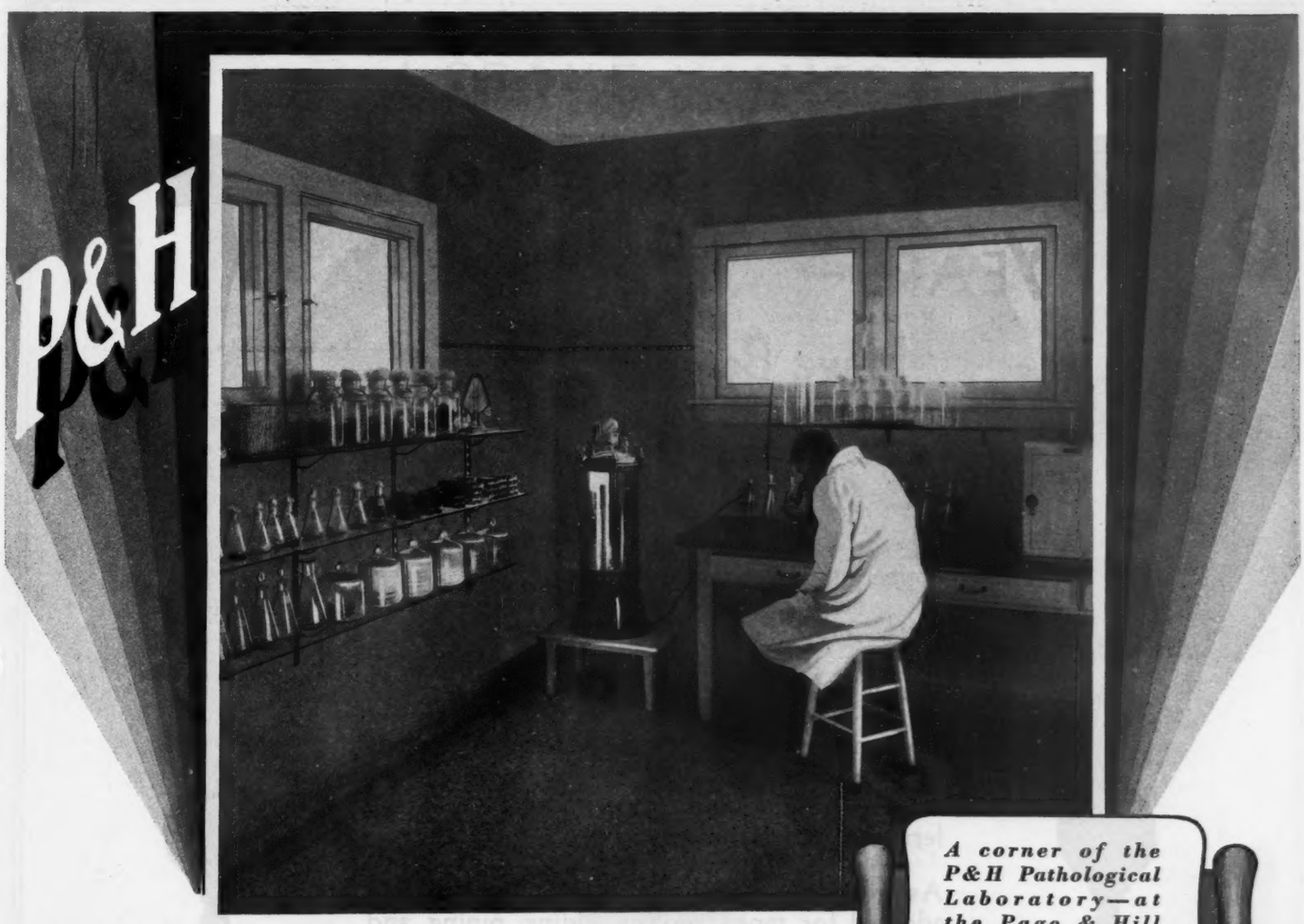
(5) The National Protector assembled on the drill pipe.

Re-read the heading of this ad then study the photos of National Casing Protector installation . . . You don't find any place where the rubber of the protector is BURNED *while it is being put on the pipe!* . . . You don't have to SLIDE National Protectors into place, neither do you have to rearrange them after they have made a few runs. . . . National Protectors *stay where they are put!* . . . When you install National Protectors onto the pipe you have the best there is installed in the *safest* known manner. . . . And you can fill a "stand" at a time without stopping if you use National Protectors. . . . There are no false claims about "speed records" with these protectors, for they "produce the goods" under all conditions. . . . For further details on National Casing Protectors, write for General Catalogue No. 29-A. . It will pay you to do this!

Full view of the National Protector. Note steel die located in groove. There is no *slipping* when these are set!

National
TOOL & METALS, Inc.

TORRANCE P. O. Box 818 CALIFORNIA



A corner of the P&H Pathological Laboratory—at the Page & Hill Saint Paul Plant.

Enlisting Science to Improve "P&H Process" Poles

IN addition to a well equipped Testing Laboratory, we maintain at our Saint Paul Plant a modern Pathological Laboratory for the study of Fungi, wood structure and the effect of the different elements in creosote. Here, under scientifically correct conditions, the organisms that cause wood to decay are isolated and studied and the toxicity of creosote tested and its effect observed.

This and other Page & Hill research is for but one purpose—the production of poles which are of greater utility and longer life.

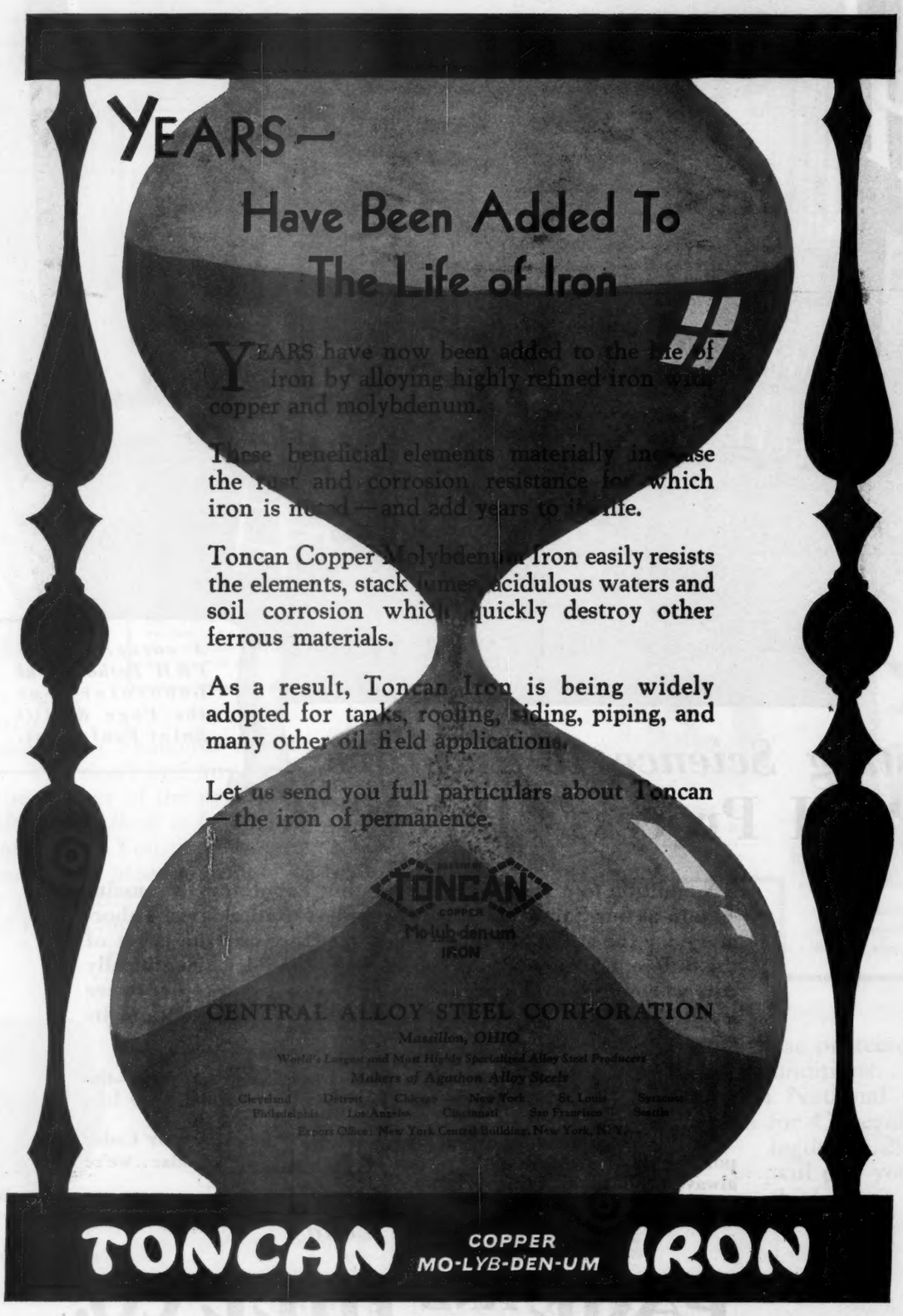
"P & H" also leads in rapid shipping service. Whatever your Cedar pole needs..Northern White Cedar or Western Red Cedar..we're always ready to meet them..promptly.

"Still in the Lead"

PAGE AND HILL CO.

MINNEAPOLIS, MINN.

Kansas City, Mo., 517 Pioneer Trust Bldg. Chicago, Ill., 19 So. LaSalle St. New York, N. Y., 50 Church St.
Omaha, Neb., 711 Electric Bldg. Dayton, Ohio, 854 Reibold Bldg. Boston, Mass., 733 Public Service Bldg.


YEARS—
Have Been Added To
The Life of Iron
YEARS have now been added to the life of iron by alloying highly refined iron with copper and molybdenum.
These beneficial elements materially increase the rust and corrosion resistance for which iron is noted—and add years to its life.
Toncan Copper Molybdenum Iron easily resists the elements, stack fumes, acidulous waters and soil corrosion which quickly destroy other ferrous materials.
As a result, Toncan Iron is being widely adopted for tanks, roofing, siding, piping, and many other oil field applications.
Let us send you full particulars about Toncan —the iron of permanence.
TONCAN
COPPER
Molybdenum
IRON
CENTRAL ALLOY STEEL CORPORATION
Massillon, OHIO
World's Largest and Most Highly Specialized Alloy Steel Producers
Makers of Agathon Alloy Steels
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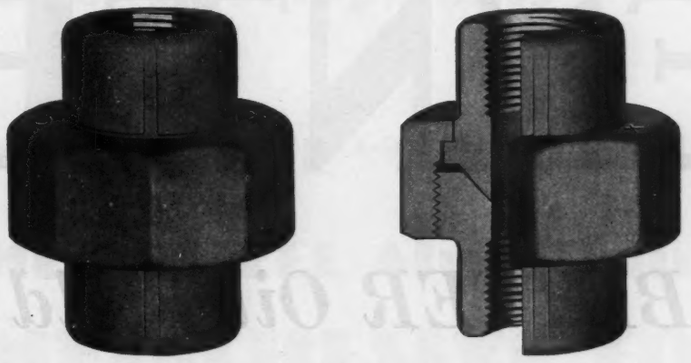
TONCAN COPPER MO-LYB-DEN-UM IRON

150 Pounds Pressure CRANE VALVES 2500 Pounds Pressure



Crane Forged Steel Union, No. 246 H. For steam working pressures up to 900 pounds at 750 degrees, and 3000 pounds at atmospheric temperature.

This new union assures utmost safety on super-power lines

For 74 years, Crane Co. has paced the piping needs of industry. Rarely has this fact been more strikingly brought out than in the materials it has designed to assure safety and absolute control of the terrific temperatures and pressures industry is now using.

As an example, examine this newly designed union, No. 246H, of steel and monel metal. The forged steel of which it is made was selected after the most rigorous tests for uniform density. Its seat is of steel to monel metal. And it is so designed that no gasket is required, yet perfect tightness assured.

This union is only one of the fittings in the complete Crane line of piping materials for high temperatures and pressures. If you have any problem in the selection of valves and fittings for this all important work, lay them before Crane engineers. They will help you by recommending materials that will eliminate both expensive waste and replacements. Details may be had by writing for Circular No. 213.

CRANE

GENERAL OFFICES: CRANE BUILDING, 836 S. MICHIGAN AVENUE, CHICAGO
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Branches and Sales Offices in One Hundred and Ninety Cities

PENNTEX

The BETTER Oil Field Belt

The logical belt construction for slow, hard-pull drives, especially in connection with small pulley diameters, is a solid construction without binder warp.

This construction eliminates ply separation (bootlegging), and cross-cracking, and gives all-around surer service.

PENNTEX BELT is *interwoven*—of solid construction throughout.

VICTOR BALATA & TEXTILE BELTING CO.

New York Office and Warehouse
38 Murray Street

Chicago Office and Warehouse
345-359 W. Austin Ave.

Factories: Easton, Pennsylvania

The Third in a Series of Successful Developments

1..METALSTEEL Acid-and-Sulphur Resisting White Paint

2..METALSTEEL Aluminum Paint

3..METALHESIVE FOILING

HAVING developed the first practical acid-and-sulphur resisting white paint (Metalsteel) and the first commercially successful aluminum paint (Metalsteel), the St. Louis Surfacer & Paint Co. now presents a third and equally sensational product — Metalhesive Foiling.

Complete Foiling Service for the Oil Industry

In the development of Metalhesive Foiling, the St. Louis Surfacer & Paint Co. has drawn on its years of past experience in the paint and protective coating fields. It offers for the first time an opportunity for those interested to secure, from a reliable, responsible source, complete information about this new method — both for exterior and interior service.

The Advantages of Metalhesive Foiling

Tests conducted by major oil companies indicate that when Metalhesive Foiling is applied to oil tanks:

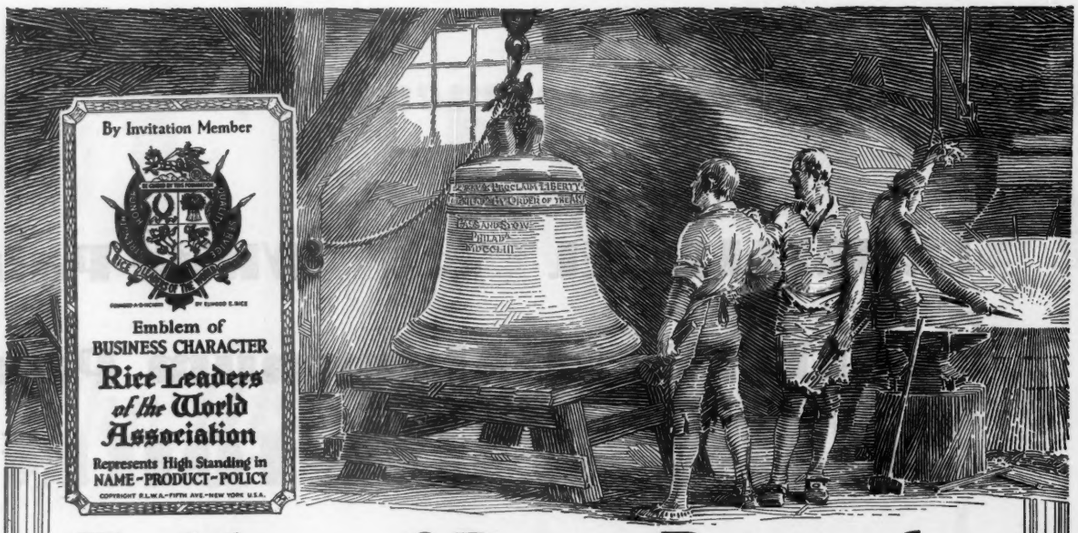
1. Regardless of its durability, its ability to lessen evaporation is worth double its cost and more—even though it lasted no longer than paint.

2. Regardless of its ability to lessen evaporation, its durability and protective properties make it worth many times its cost.

Executives of the company will gladly discuss Metalhesive and Synphenol Foiling and co-operate in any tests designed to prove the suitability of these new protective systems under specific conditions.

ST. LOUIS SURFACER & PAINT CO.

Arlington Ave. & Terminal Belt Line . . St. Louis, Mo.



Emblem of Basic Principles

For generations the historic old Liberty Bell has symbolized the basic principles of our land, proclaiming to all the inspiring message of Freedom, Equality, Justice and Truth. Upon these fundamentals the great American Republic has grown, to a position of leadership among the nations of the world.

For sixteen years the Emblem of the Rice Leaders of the World Association has symbolized and proclaimed the basic business principles of

Honor—Quality—Strength—Service

The fact that the DARLING VALVE & MFG. COMPANY is a member of this Association is evidence that we qualify on all four points. It testifies that we have builded and conducted a growing, successful, world-wide business upon the broad foundations of permanence.

The basic principles portrayed in the Association Emblem are the essence of what you may expect when you entrust us with your Gate Valve business. These principles warrant the quality of "DARLING" Products, assuring you of honest value and satisfaction for the money you spend.

Darvai Semi-Steel Gate Valve, Dar-o-loy trimmed. Made in all sizes for general field use, pipe lines, drilling through, well control and well flow lines.

DARLING VALVE & MFG. COMPANY
Williamsport, Pa.

New York Chicago Oklahoma City Houston

Mid-Continent Distributors:
Frick-Reid Supply Corp. Atlas Supply Co.
International Supply Co. Petroleum Supply Co.

California Distributor:
Petroleum Equipment Company, Los Angeles

Foreign Sales Manager:
H. M. Hein, Room 1405, 152 West 42nd Street, New York, N. Y.

DARLING GATE VALVES

Darling Forged Steel gate Valve, Dar-o-loy trimmed, for drilling well control, flow lines and other hazardous conditions.

Nation-Wide in Scope and Vision

PIONEERING with, and for, the natural gas industry, Hope Service—with a background of twenty-three years of experience—visions the expansion of the industry into wider fields and broader markets still untouched.

With confidence in this future expansion, and prepared by its experience of the past, the Hope Company is ready—with manpower, resources and equipment—to undertake any natural gas development, of any magnitude, anywhere, in any season, and on any notice. Six thousand miles of Hope-built pipe lines attest the ability of the Hope Company to make good its promises.

HOPE SERVICE

Field and Market Analysis
Engineering Counsel and Design
Organization and Finance
Construction and Equipment
Management and Operation

HOPE ENGINEERING CO

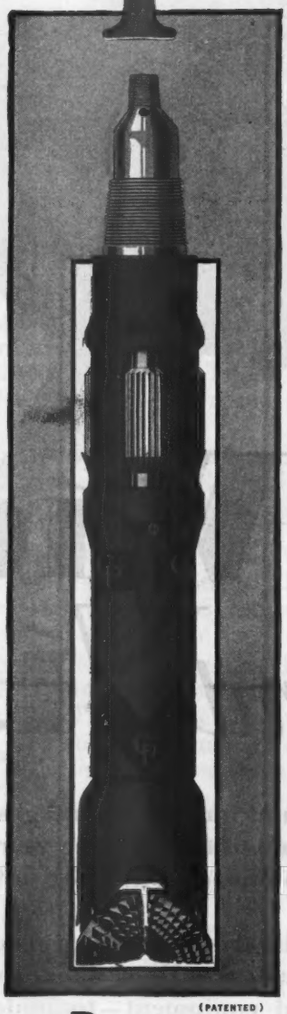
ENGINEERS AND CONTRACTORS IN PIPE LINE CONSTRUCTION

NEW YORK, N.Y. — Engineering-Construction Management — TULSA, OKLA.

MOUNT VERNON, OHIO, U.S.A.

"AMERICAN INDUSTRY NEEDS MORE NATURAL GAS"

With the NEW CP "Tucone" ROCK BIT



(PATENTED)

9 POINTS OF SUPERIORITY

1. SAFETY—Extra large drop-forged spindle bearings. No cone bushings. One-piece bit head. One-piece reamer body. FISHING ELIMINATED
2. CIRCULATION—Fluid stream jets directly on bottom of hole. No side-wall hydraulicking. STRAIGHT HOLE
3. CLEARANCE—Over 34% of hole area is clear. "Balling up" eliminated. STRAIGHT HOLE
4. CONES AND SPINDLE BEARINGS—Cones run on extra large replaceable drop-forged spindle bearings. Stronger and thicker cone wall section due to absence of bushing. GREATER STRENGTH
5. REAMERS—Three units, properly spaced and located for accurate reaming. New type reamer bearing eliminates wear on reamer body. KEEPS GAUGE—ALWAYS!
6. ONE-PIECE BODIES—Both bit and reamer bodies are solid manganese steel. GREATER STRENGTH
7. REPLACEMENTS—Cone-and-bearing units and reamers easily and quickly changed. TIME SAVED
8. LOW MAINTENANCE—Body repairs eliminated. No wear on bit head or reamer body. MONEY SAVED
9. CONE SERVICE—New CP "Red Head" cutting cones can be refitted on your used bearings (only at authorized CP Service Stations) and guaranteed by CP to be as good as if a new bearing were used—at a great saving to you! ECONOMY

QUICK REPLACEMENTS!

Cone-and-bearing units and reamer cutters speedily changed. TIME SAVED!

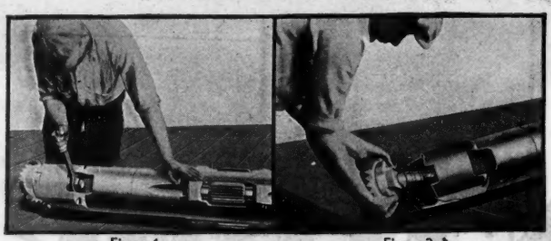


Figure 1. Figure 2.

ALL that is necessary to remove the CP Cutting Cone Unit from the bit body is to take out the cotter pin, nut, lock nut and washer (Fig. 1)—and the complete assembly slides out of the bit body! (Fig. 2). A COMPLETE CHANGE OF CP CUTTING CONE UNITS CAN BE MADE IN 20 MINUTES!

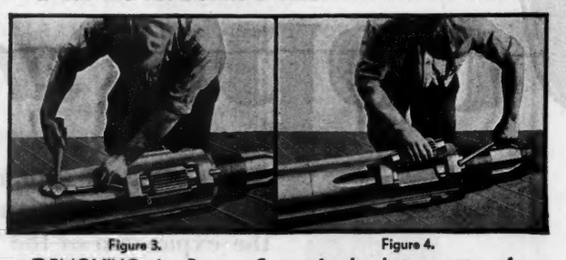


Figure 3. Figure 4.

REMOVING the Reamer Cutters is also but a matter of minutes! Simply take out the cotter pin, drive out the reamer bearing pin (Fig. 3), and lift out the Reamer Cutter! (Fig. 4). The Reamer Cutters and bearings and the Cutting Cone Units are the ONLY wearing parts on the CP "Tucone" Rock Bit!

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: Chicago Pneumatic Bldg., 6 East 44th St., New York

OIL TOOL DIVISION OFFICES:

OKLAHOMA CITY, OKLA — 655 Santa Fe Ave., LOS ANGELES, CAL.

KEEPS GAUGE "ALWAYS!"

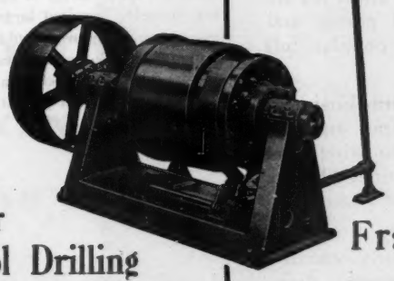
OT-17

That the use of CP "Tucone" Rock Bits will unquestionably result in lower drilling costs, we are ready and willing to prove in any way YOU say! An inquiry to any of the above addresses will receive immediate attention.

Franklin Valveless Oil and Gas Engines

Some of the Franklin OF Good Points

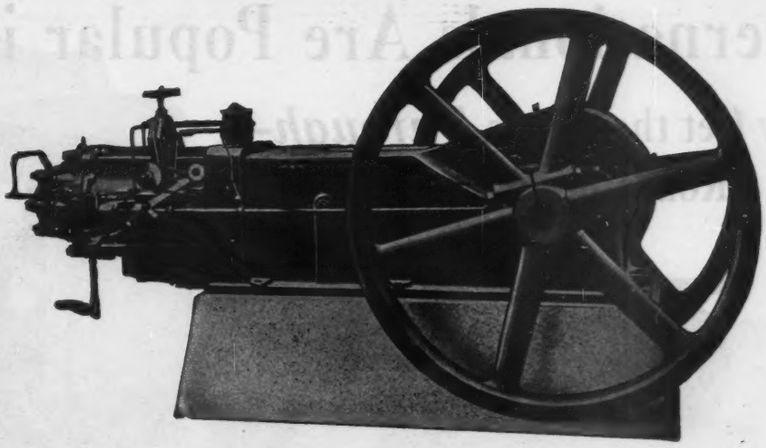
- Enclosed type
- Low fuel consumption
- 100% interchangeability
- Simplicity
- Piston rod is fitted with metallic packing which never needs adjusting or replacing
- Every spring exposed
- Complete simplicity with practically no adjustment
- In case of belt breakage engine automatically stops
- Fuel pump driven by eccentric running in oil bath
- Bearings are removable and reversible
- Only standard threads used. No special wrenches required
- Cylinder has 3 point force feed lubrication
- Balance of lubrication is splash feed
- Pistons are air cooled
- All nuts subject to vibration are castillated and fastened with cotter pins
- Most economical to operate in fuel, lubricant, water and repairs
- Easy to start



Type BG Clutch for Cable Tool Drilling or Pumping

- A vast improvement over the former type of clutches.
- Driven from pulley on engine. Permits the use of a larger diameter pulley and makes possible a slower clutch speed. Operates by hand lever on derrick.
- Construction and design prevent Reverse Clutch Troubles.

PRICE—$1200.00 F.O.B. Franklin, Penna.



Here Is Practical Standardization

The new and improved Franklin Oil Engine, identified as type OF is made in three sizes: 12 x 16 (40 HP) and 13 x 16 (50 HP) and 16 x 16 (80 HP) for drilling, pumping and power.

ALL FRANKLIN VALVELESS 16″ STROKE ENGINES ARE INTERCHANGEABLE ON THE SAME BLOCK

After drilling the well, the operator can install one of the lighter units upon removal of the drilling engine. It fits the same block perfectly.

It is to the operator's interest to see that his drilling contractors use the Franklin since by doing so the cost of a new engine base is eliminated.

Here is practical standardization in which the benefits are mutual.

Send for literature.

Franklin Valveless Engine Company
Franklin, Penna.

PRICES

40 H.P. Type OF Franklin, including water circulating pump and pulley. *$1550 F.O.B. Franklin*

50 H.P. Type OF Franklin, including water circulating pump and pulley. *$2050 F.O.B. Franklin*

80 H.P. Type OF Franklin, including water circulating pump, pulley and air starting equipment. *$3200 F.O.B. Franklin*

NOTE—Type OF is readily converted into type OG for gas fuelization.

Distributed by

OIL WELL SUPPLY COMPANY

Branches in All Oil Fields

Internationals Are Popular in the Oil Country

They Get the Loads *Through*— Roads or No Roads!

C. M. Jeffries, Borger, Tex., owns the International Truck above. The scene to the left shows the loading of a cable drum on an International HS-74, operated by the Exchange Drilling Co., Semin-le, Okla. Joseph D. Hughes, trucking contractor at Houston, Tex., finds Internationals dependable for hauling loads like the one at the right.

S. S. Gibson of Seminole, Okla., is one of the trucking contractors in the Seminole field who likes Internationals. He has seven of these trucks.

If you've ever frogged a big boiler or a mud hog through bottomless oil-country roads you know what it means to have the right kind of a truck under you. You know it's no job for a weakling. It demands the kind of power and strength that has made International the most popular full line of trucks in the oil fields.

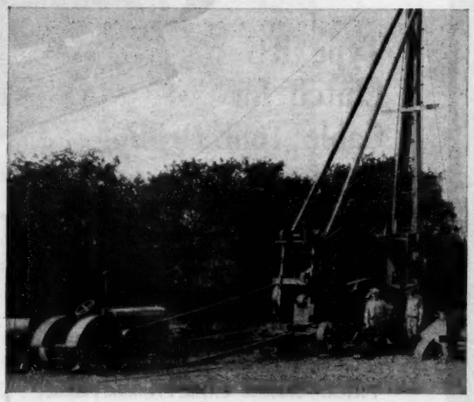
There are many hundreds of Internationals in this business. They are getting rotary rigs, cable rigs, line pipe, supplies, and what-not to and from location. They are showing fleet owners real economy in motor truck transportation. They're on the job day in and day out, because they are engineered and built to stand the gaff.

Service in a hurry is always available because our Company-owned branches, scattered through the oil country, carry large stocks of parts and have mechanics who "know their stuff".

Pick out the worst going you know of and ask the nearest International Harvester branch for a demonstration. When you drive one of these trucks you will begin to see why there are so many Internationals in the oil business.

INTERNATIONAL HARVESTER COMPANY
of America
(Incorporated)
606 So. Michigan Ave. Chicago, Illinois

McCormick-Deering Industrial Tractors are used widely in the oil fields wherever mobile power is needed. They combine with a variety of equipment to handle many jobs that formerly required large crews of men. They work faster than manpower could and at a much lower cost. The McCormick-Deering tractor shown below is owned by Peter Brown of Oklahoma City. It is drilling a water well—one of the belt jobs it does easily.



International Harvester

TRACTORS — TRUCKS — POWER UNITS

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

Copyright 1929 Axelson Machine Company

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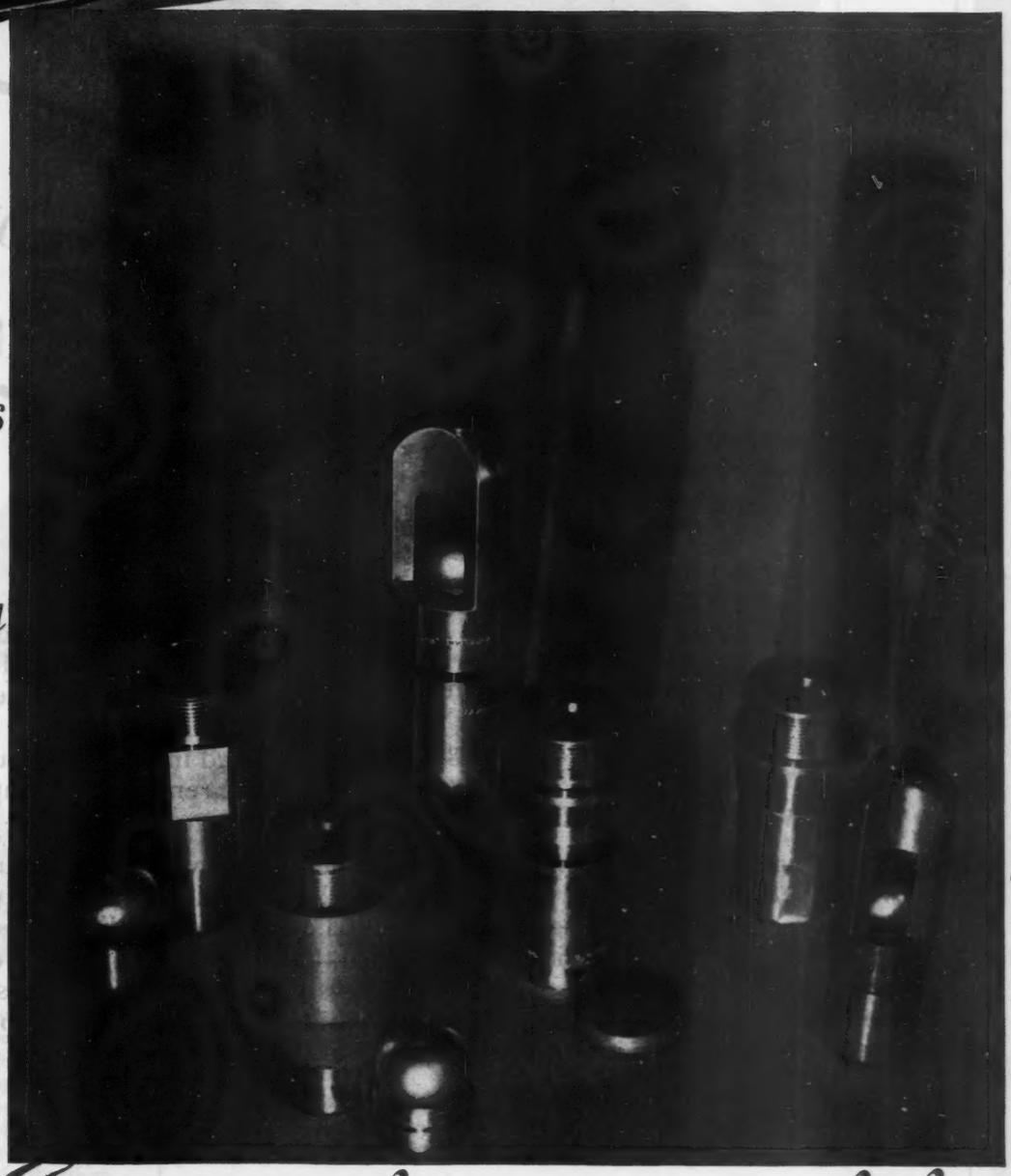
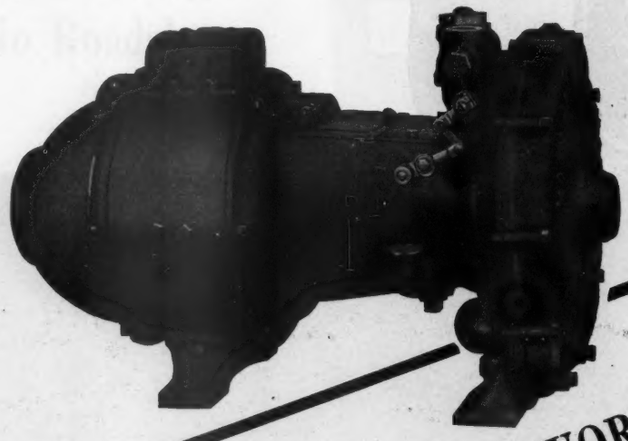


Shadows of Quality

....NEVER A COMPROMISE IN QUALITY IN THE AXELSON PLANTS... EVERY PART IS FULLY STANDARDIZED

THE *Interchangeable* PUMP

A PRODUCT OF AXELSON



DERRICKS THE WORLD OVER
ARE LIGHTED BY
MOON TURBO GENERATORS

THE overwhelming success of Moon Turbo Generators is easily explained. They embody the most necessary essential of all lighting equipment—RELIABILITY.

The one great problem which has always confronted the oil man is DEPENDABLE LIGHT at night when a breakdown can mean personal injuries and drilling delay.

Moon Lighting Equipment found in every field today is the result of twenty years of engineering research. It is constructed with the idea that it "must not fail" at any time. This has necessitated that quality and endurance be built in.

All working parts such as the governor and ball bearings operate in a vapor of oil in a small sealed chamber separate from the steam head. The armature and fields can be removed and replaced in twenty minutes' time simply by removing 2 nuts and 6 screw caps.

There are few parts to adjust or disturb. All Moon Equipment is constructed along the lines of simplicity so that there may never be costly delays. Put Moon Generators on your job and your mind is free of lighting worries.

There is a Moon Generator of the proper type and size for your work. WRITE TODAY for information and prices.

Republic Supply Company

OIL AND GAS WELL SUPPLIES
Cable and Rotary Tools

GENERAL OFFICES: HOUSTON, TEXAS

The Call for "Guts"

Whenever a part calls stridently for "guts" beyond the ordinary limits, manufacturers naturally turn more and more to Sivyer. For at Sivyer they find the long list of Sivyer alloys that meet the most exacting demands. This trend in heavy duty manufacture explains why P & H came to Sivyer for teeth on the Trench Hoe, pictured above. The teeth are now cast in Sivyer alloy steel—completely answering the call for "guts".

This P & H Trench Hoe has no easy job, and the teeth are asked to meet and take all the sudden, severe shocks and strains of digging. Such a job is typical of what can be done by Sivyer Alloys. The book, "Sivyer Alloys," a recent addition to the Sivyer Library, tells more details of possibilities. A copy may be had for the asking.

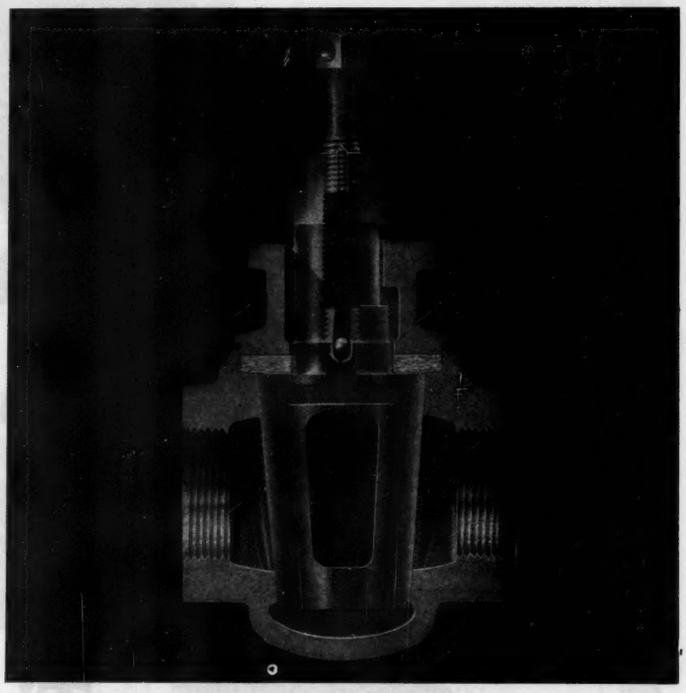
SIVYER STEEL

SIVYER STEEL CASTING COMPANY, MILWAUKEE

WIN $250.00 CASH

18 Other Cash Prizes, Too! Total $500.00

WRITE A SIMPLE SLOGAN



This offer is open to every reader of this announcement. It makes no difference who you are or where you live. We want a new slogan for Nordstrom Valves. Whoever sends the best slogan will win $250.00. If you don't win the big cash prize, there are 18 other cash awards—any one of which may go to you.

"Won't Stick—Won't Leak" has been our slogan for years. But now we want something new—a slogan that will express in a few words the advantages of Nordstrom Valves. A brief synopsis of these advantages is given in this advertisement. Read it carefully. Or send for literature which may help you to submit the winning slogan.

CASH AWARDS

First Prize . .	$250.00
Second Prize . .	100.00
Third Prize . . .	50.00
4 Prizes, each . .	10.00
12 Prizes, each . .	5.00
TOTAL 19 CASH PRIZES	$500.00

Any slogan may win. No matter how simple your slogan may sound to you—send it in. You cannot afford to neglect this big opportunity to win one of the generous cash prizes offered. Remember — there is no obligation! The persons submitting the winning slogans will have nothing else to do. We have nothing to sell in this contest. Get busy with your slogans at once. A little time—a little thought—may win for you. Contest closes December 31st. Only a short time left!

RULES of Contest

Anyone is eligible except employees of Merco Nordstrom Valve Company or affiliated companies. Slogan must not exceed 10 words. Any number of slogans may be submitted by same person. Use coupon below or separate sheet of paper. In the event of a tie for any of the prizes offered, each winner of the respective award will receive the same cash amount.

MERCO
REG. U.S. PAT. OFF.

Ask for Literature

NORDSTROM VALVES *(lubricated)*

Stop Leaks
Prevent Sticking
Plug always easy to Turn

Nordstrom Valves are of the plug cock type, with lubrication and lifting features that make them easy and sure of operation. A stick of special "Merco" Lubricant is inserted under the lubricant screw. The latter, when turned, forces the lubricant down and around the plug. Fluid or other material within the line cannot pass around the plug and leak out, or lodge in the seat. The plug is always easy to turn. Made in types and sizes to meet conditions in all industries.

FILL IN THIS ENTRY BLANK AND MAIL

MERCO NORDSTROM VALVE CO.,
343 Sansome St., San Francisco, Calif.

I submit the following slogan(s) pertaining to Nordstrom Valves:

_____

_____

_____

_____

Name _____

Address _____

City _____ State _____

(Use separate sheet if several slogans are submitted)

Merco Nordstrom Valve Co.
SUBSIDIARY OF THE MERRILL COMPANY
Engineers - Manufacturers

Atlanta: Healey Bldg.
Boston: 184 Boylston St.
Buffalo: Genesee Bldg.
Chicago: 176 W. Adams St.
Dallas: Magnolia Bldg.
Detroit: 2842 W. Grand Blvd.
El Paso: 111 S. Virginia St.
Houston: Petroleum Bldg.
Los Angeles: 556 S. San Pedro St.
New Orleans: Masonic Temple Bldg.
New York: 11 W. 42nd St.
Pittsburgh: Clark Bldg.
Portland: Buyers Bldg.
San Francisco: 343 Sansome St.

AGENCIES IN PRINCIPAL CITIES

Factories—Oakland, California; and Belleville, New Jersey
Canadian Manufacturers—Peacock Bros., Ltd., Montreal, Cobalt, Winnipeg, Vancouver
England—Audley Engineering Co., Ltd., Newport, Shropshire
Buenos Aires, Argentine—General Electric, Soc. Anon., Victoria 618 Esq. Peru

AMERICAN HEAVY DUTY ROLLER BEARINGS

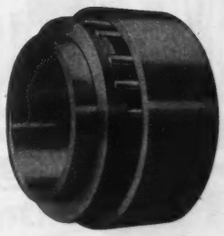
for these

Traveling Blocks
Crown Blocks
Reverse Clutches
Rotary Drives
Gear Drives
Drilling Machines
Winches
Hoists

and for any hard working Heavy Duty Equipment—

The Standardized Bearing for the Oil Industry

consider the simplicity of installation and maintenance when Heavy Duty AMERICAN roller bearings replace plain bearings.



AMERICAN Heavy Duty bearings are installed practically the same as plain bearings. Housing bores are straight and of minimum diameter. Adjusting shims or threaded housing closures are unnecessary. Installed they are a duplicate of a plain bearing installation with only a slightly larger outside diameter.

An installation of this type is of highest efficiency, of practically endless life, of greatest load capacity, and of maximum simplicity. It requires very little lubrication, no adjustment for wear, no special housing design.

AMERICAN Bearings are built in designs to meet every requirement of load and speed. They can displace any plain bearing at small expense and with minimum change in design.

This is the bearing for industrial heavy duty use only. It has a record of fifteen years specialization in heavy duty service and is in use in practically every industry. Particularly has it become the standardized bearing of the oil industry.

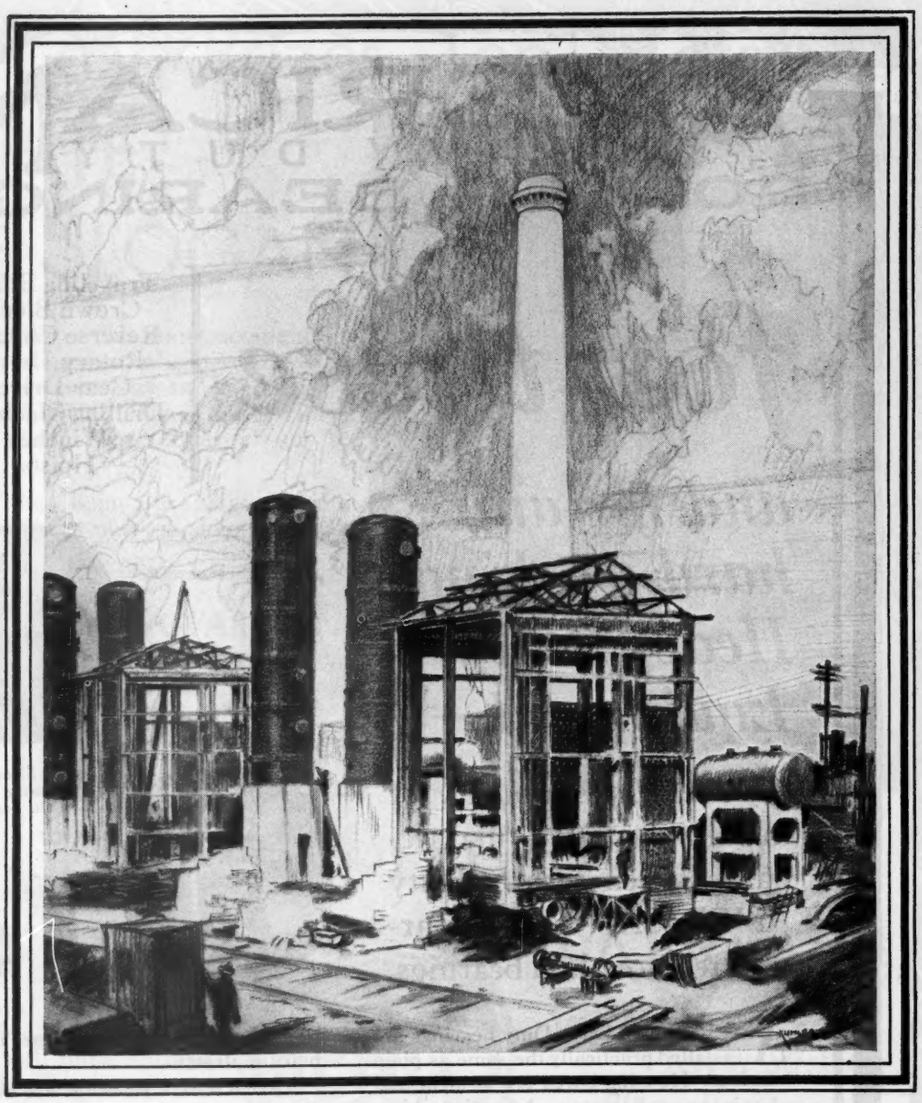
Let us figure their application for your heaviest duty.

Pacific Coast Representatives:

FRANK M. COBBLEDICK CO.
1031 Polk Street, San Francisco, California

EDWARD D. MALTBY CO.
321 W. Pico Street, Los Angeles, California

AMERICAN ROLLER BEARING CO.
PITTSBURGH, PENNA.



Kellogg Developments IN REFINERY DESIGN HAVE SET NEW STANDARDS OF PERFORMANCE

To anticipate the needs of the petroleum industry, Kellogg research and planning have been projected beyond the limits of present practice. In this way, Kellogg is able to offer an exceptional service in refinery design and construction, providing in actual operation new, and higher, standards of performance.

The M. W. KELLOGG COMPANY

225 Broadway, New York

DALLAS, TEXAS, 714 KIRBY BLDG. LOS ANGELES, CAL., 1031 SO. BROADWAY TULSA, OKLA., PHILTOWER BLDG.

a. c. f. Tank Car built to I. C. C. Specification No. 103

a.c.f. Tank Cars

ALL CLASSES FOR ALL COMMODITIES

●

Considering the large orders already received and many other indications of the need for additional tank cars during 1930, it is wise for buyers to immediately negotiate for shop space in order to secure satisfactory deliveries.

●

Always Get a "Car Foundry" Quotation

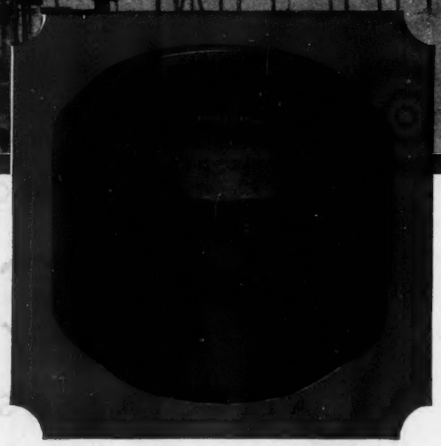
American Car and Foundry Company

30 CHURCH ST., NEW YORK CHICAGO ST. LOUIS

a.c.f.

IN THE SERVICE OF THE NATION'S RAILWAYS, HIGHWAYS, WATERWAYS, INDUSTRIES

"Best bet yet!"



Fully Patented

In Venezuela 9250 Bettis Protectors are cutting drilling costs

Practically every deep well now drilling in Venezuela is Bettis-protected. The deepest well ever drilled outside of the United States, at Venezuela, was drilled with the aid of Bettis Protectors. Operators in all South American oil fields have adopted these dependable protectors almost without exception. There are 55 definite reasons WHY, — explained in our new Catalog. Ask for a copy.

Patterson-Ballagh Corporation

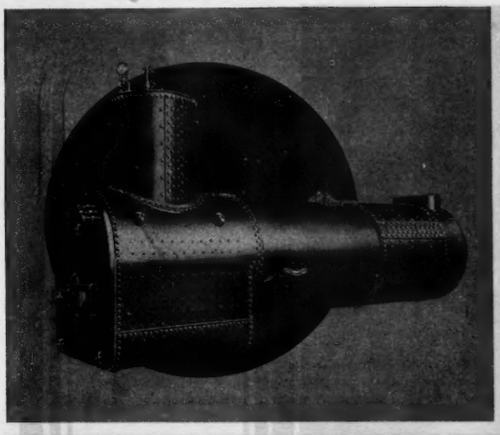
Insurance Exchange Bldg., Los Angeles, Calif.

New York City Office—39 Cortlandt St.

Texas and Gulf Coast Distributors: Bettis Sales Co., 616 Pub. Nat. Bank Bldg., Houston

Oklahoma Distributors: Bailey & Becker Co., 2416 N. Boston Pl., Tulsa

Stocks carried in Los Angeles, Santa Fe Springs, Ventura, Kettleman Hills, Bakersfield, Coalinga, Long Beach, Tulsa, Houston, Wink, Calgary, Alberta, Can.; New York City.



DONOVAN BOILERS

Chosen wherever *fuel economy* is desired

EVERYWHERE

Manufactured by

DONOVAN BOILER WORKS, Inc.
PARKERSBURG, W. VA.
NEW YORK OFFICE—30 Church Street
FRICK-REID SUPPLY CORPORATION
Mid-Continent and Eastern Distributors
GREAT NORTHERN TOOL & SUPPLY CO.
MIDLAND IRON WORKS
Montana Distributors

All Leading Supply Houses Throughout the Eastern Fields Handle

DONOVAN QUALITY PRODUCTS
NONE BETTER

Corning, Arkansas

DONOVAN BOILER WORKS,
Parkersburg, W. Va.

Dear Mr. Donovan:

¶ We wish to compliment you on the improvement you have made in oil well boilers, and will say that the 60 H.P. boiler we purchased from you on Sept. 30 is certainly a model of workmanship and has given us entire satisfaction in every sense of the word.

¶ If we were in the market for a dozen oil well boilers, we would buy nothing but this DONOVAN 60 H.P. boiler.

¶ We had been using a 40 H.P. boiler and replaced it with this boiler of yours, which has saved us at least 40% of fuel over operating the other boiler. This saving alone, in a very short time, will pay for the boiler.

¶ With kindest personal regards, we are

Yours very truly,

CLAY COUNTY OIL CO.,
(Signed) George A. Booser,
Secretary.

Permanent Satisfaction ...with Goulds Pumps

IN every phase of oil production where reliable pumps are absolutely essential, Goulds Pumps have earned the confidence of operators. Cracking-still pumps, pipe-line pumps, feed- and cooling-water pumps, fire pumps—Goulds pumps, large and small, are operating 24 hours every day or are at instant readiness for emergencies.

The photograph above shows a battery of electric-motor-driven, multi-stage and single-stage centrifugals in an Oklahoma refinery. The illustration below shows a pipe-line installation of Diesel-engine-driven reciprocating pumps. Regardless of the service demands—regardless of the character of the liquid to be handled—there is a Goulds pump to fulfill the requirements.

Goulds engineers — pump specialists — are always ready to help you solve your pumping problems.

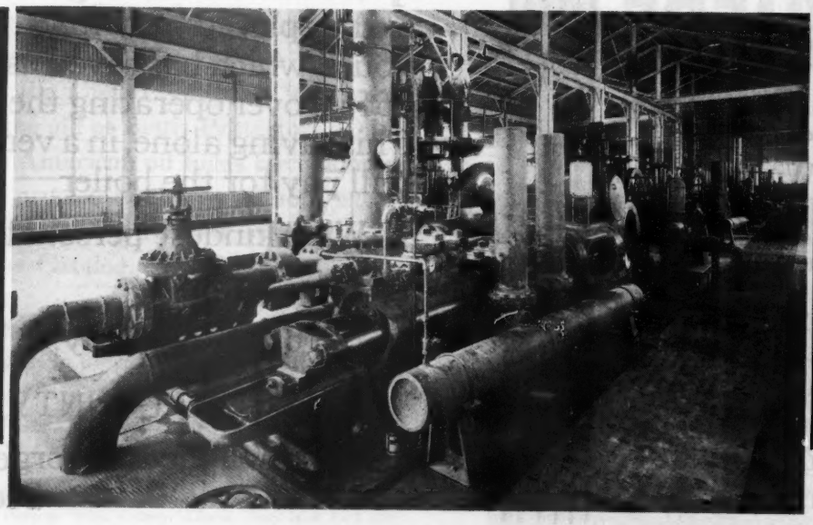
GOULDS PUMPS

(INCORPORATED)

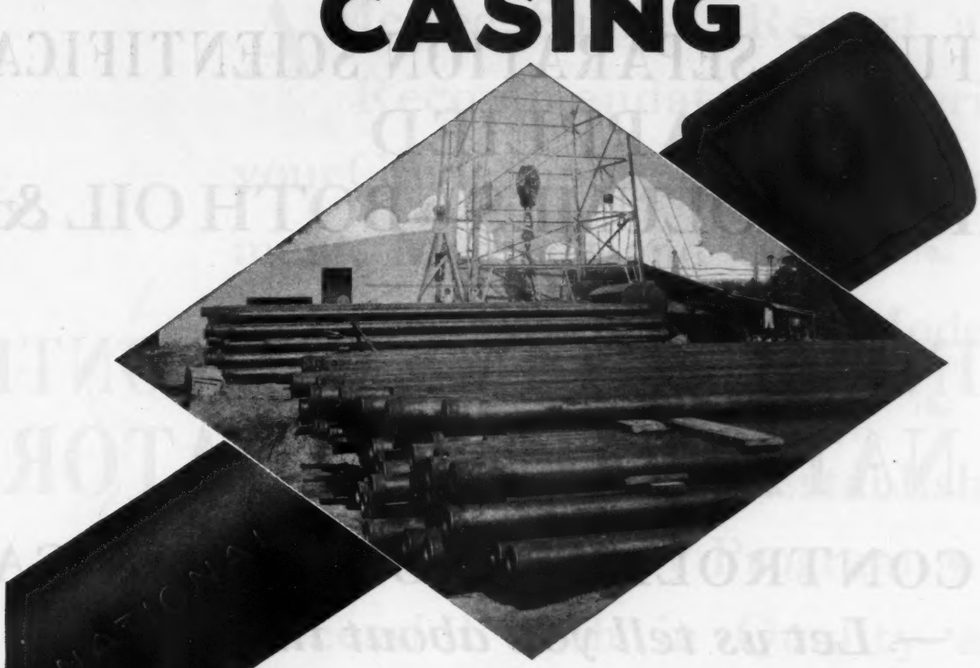
SENECA FALLS, NEW YORK

Houston, Texas
1902 Second National Bank Bldg.

Tulsa, Oklahoma
705 Kennedy Building



NATIONAL
A.P.I. DIAMOND BX and B8
CASING



The Standard of America's Oil Fields!

NO greater tribute to high quality and satisfactory service could be given any product than its constant specification and use by leading operators the country over. In practically every oil field, and particularly in deep well sections, NATIONAL A. P. I. Diamond BX and B8 Casing is recognized as the standard for reliable service.

Every length of NATIONAL Casing has the same carefully laid foundation for successful performance. There are no short cuts in building the character of this product—no division of responsibility—one organization controls every step of the way. Modern mechanical methods, skilled workmen, and an intensive system of inspection and tests, all combine to maintain a degree of uniformity and quality of product that is unsurpassed.

It is only natural that casing made under these favorable conditions should prove highly satisfactory in service and become the standard of America's oil fields.

NATIONAL TUBE COMPANY

Frick Building, Pittsburgh, Pa.

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

PRINCIPAL SUBSIDIARY MANUFACTURING COMPANIES:

American Bridge Company
American Sheet and Tin Plate Company
American Steel and Wire Company
Carnegie Steel Company
Cyclone Fence Company
Federal Shipbuilding and Dry Dock Company
Illinois Steel Company
Minnesota Steel Company
National Tube Company
The Lorain Steel Company
Tennessee Coal, Iron & R. R. Company
Universal Portland Cement Company

Pacific Coast Distributors—United States Steel Products Company, San Francisco, Los Angeles, Portland, Seattle, Honolulu. *Export Distributors*—United States Steel Products Company, New York City

NATIONAL
OIL and GAS
SEPARATORS

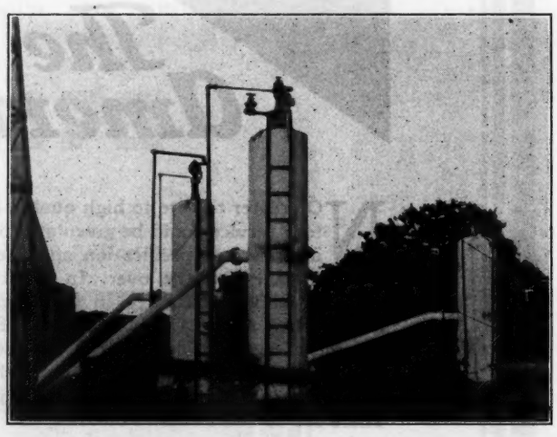
CENTRIFUGAL SEPARATION SCIENTIFICALLY APPLIED
FOR LARGE VOLUMES—BOTH OIL & GAS

LORRAINE DUAL OIL & GAS CONTROLS
ON NATIONAL SEPARATORS
FOR CONTROLLING BOTH OIL & GAS

Let us tell you about them

Two No. 1-A NATIONALS handling the largest oil well in the Oklahoma City Field.

ALL HANDLED SUCCESSFULLY WITH NATIONAL SEPARATORS

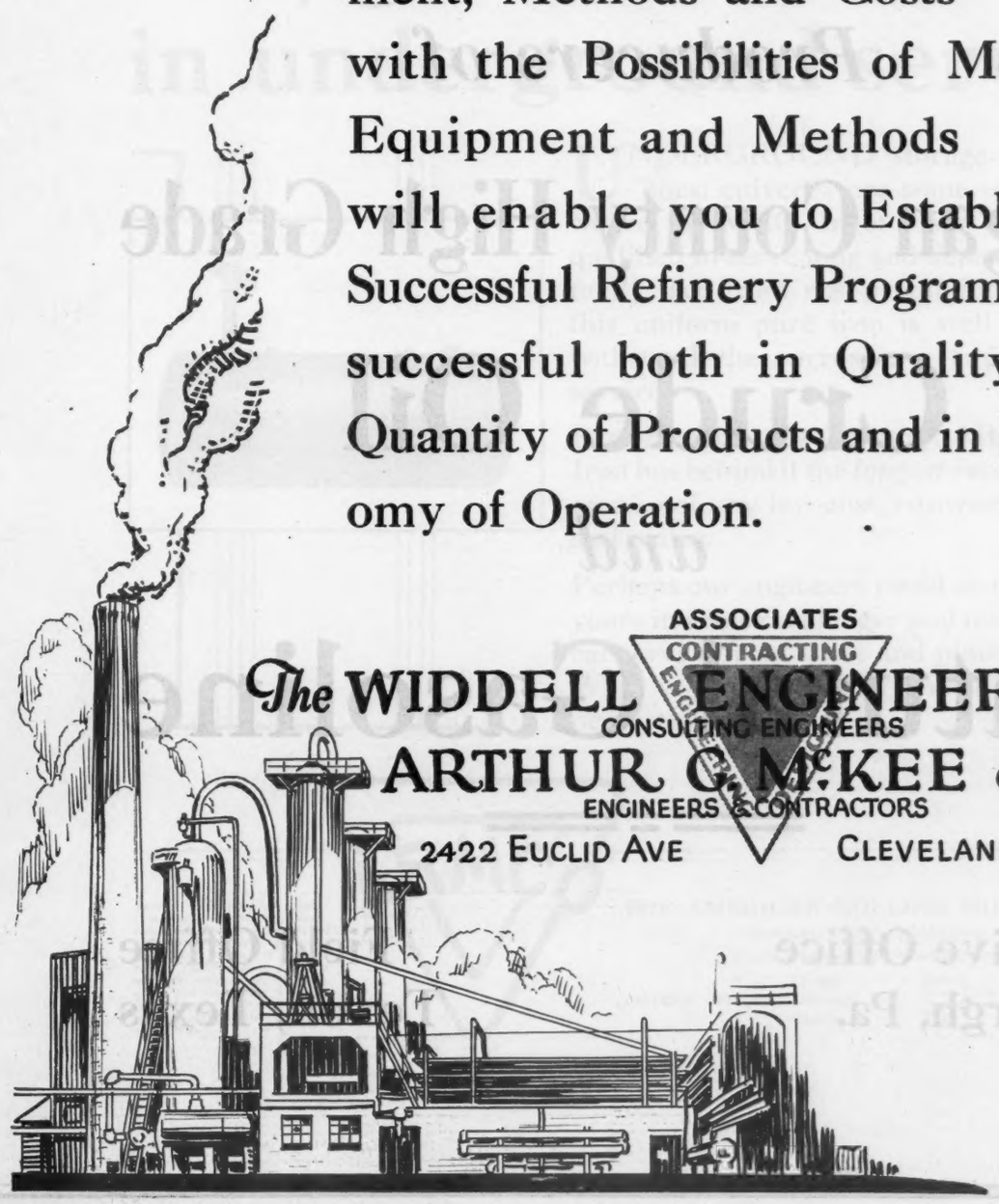


Three No. 4-A NATIONALS handling the largest gas and gasoline well in the Oklahoma City Field. Over 200,000,000 cu. ft. gas and 3,000 bbls. gasoline.

NATIONAL TANK CO.
TULSA, OKLA.

Establishing a Successful Refinery Program

A McKee Survey, Report and Recommendations covering your Crude Supply, Markets, Equipment, Methods and Costs with the Possibilities of Modern Equipment and Methods will enable you to Establish a Successful Refinery Program successful both in Quality and Quantity of Products and in Economy of Operation.



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CONTRACTING ENGINEERS

The WIDDELL ENGINEERING CO
CONSULTING ENGINEERS

ARTHUR G. McKEE & CO.
ENGINEERS & CONTRACTORS

2422 EUCLID AVE CLEVELAND, OHIO

Big Lake
Oil Company

Producers of

Reagan County High Grade
Crude Oil
and
Natural Gasoline

Executive Office
Pittsburgh, Pa.

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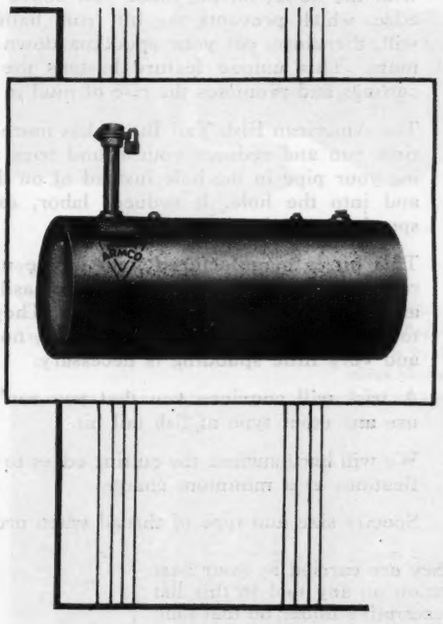
ARMCO INGOT IRON

fights corrosion in underground service



UNDERGROUND storage tanks, pipe lines, culverts, are some of the places where ARMCO Ingot Iron is especially qualified to serve long and dependably. Virtually free from rust-promoting impurities, this uniform pure iron is well fortified to withstand the corrosive attacks of such service.

Performance tells the story. ARMCO Ingot Iron has behind it the *longest record of actual service* of any low-cost, rust-resisting sheets and plates.

Perhaps our engineers could co-operate with yours in achieving longer and more economical service from sheet and plate equipment. What is your problem? Write or wire the nearest office.

ARMCO

Back of this familiar symbol is nearly thirty years of experience in the manufacture of special analysis iron and steel sheets and plates. When you seek a rust-resisting, low-cost metal be sure to see this triangle, and the words "ARMCO Ingot Iron". It is your assurance of dependable, economical service.

THE AMERICAN ROLLING MILL COMPANY

Executive Offices, Middletown, Ohio

Export: The ARMCO International Corporation

DISTRICT OFFICES: Chicago, Cincinnati, Cleveland, Detroit, New York, Philadelphia, Tulsa, Pittsburgh, St. Louis, San Francisco

Fishing Tools Drilling Tools

AMERICAN IRON & MACHINE WORKS, INC. · OKLAHOMA CITY ·

A NEW ROTARY DRILLING BIT

AMERICAN FISH TAIL BITS
(PATENTED)

Keep your pipe in hole with this tool

Reduce round trips 50%

A trial will convince you

This bit is a departure from the conventional design of Rotary Drilling Bits and is especially effective in drilling Gumbo or soft formation. The Water Courses extend through the entire body of the bit with the outlet on the blade just above the cutting edge, which prevents the bit from balling up and will, therefore, cut your spudding down to a minimum. This unique feature hastens the mixing of cuttings and promotes the rise of mud in the hole.

The American Fish Tail Bit makes more hole every time run and reduces your round trips 50%, keeping your pipe in the hole instead of on the way out and into the hole. It reduces labor, expense and speeds up production.

This bit is manufactured with ample material for redressing, and cutting surfaces are easily prepared and hard surfaced for long service. They hold well to gauge and there are no twist-offs, no balling up and very little spudding is necessary.

A trial will convince you that you can't afford to use any other type of fish tail bit.

We will hard surface the cutting edges to your specifications at a minimum charge.

Specify size and type of thread when ordering.

Look over the American tools listed below. They are carried by your best supply company. If you want detailed information on any tool in this list write to us and we shall be glad to send you a descriptive folder on that tool.

AMERICAN IRON & MACHINE WORKS CO.

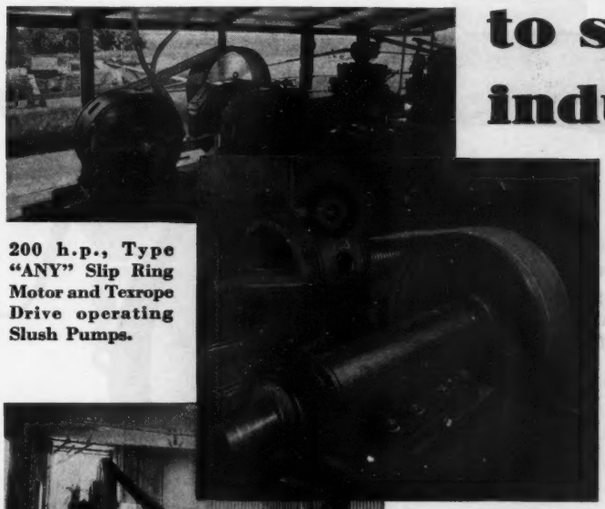
Manufacturers of Oil Field Equipment

Oklahoma City, U. S. A.

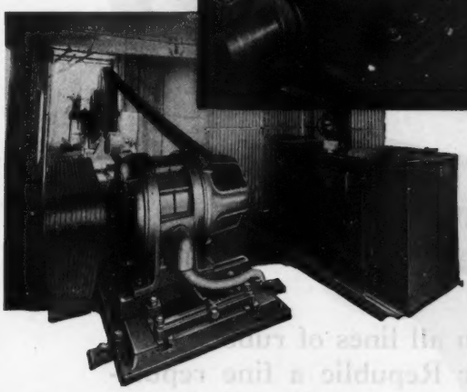
AMERICAN OIL FIELD EQUIPMENT

American Releasing and Circulating Overshots
American Rock Bit Wrenches
American Milling Shoes
American Flexible Coupling for Rock Bit Lubricators
American Steel Tool Houses
American Steel Tool Boxes
American Forged Steel Wall Hooks
American Rock Bit Breakout Blocks
American Paraffin Bits
American Female Die Nipples
American Forged Steel Drill Collars
American Tapered Taps
American Forged Steel Subs
American Rotary Shoes
American Cone Fishing Baskets
American Steam Lubricators
American Side Tracking Mills
American Combination Reverse and Throttle Levers
American Steel Engine Foundations
American Rock Bit Lubricator Wash Pipe Attachments
American Rotary Milling Tools
American Automatic Cathead Control
American Automatic Cathead Control Levers
American Myracle Sucker Rod Sockets
American Surface Bit Blades for Rock Bits
American Drill Pipe Float Joints
American Pump Manifold Check Valves
American Eccentric Releasing Overshot
American Casing Suspension and Blowout Preventer
American Lead Plug
American Rock Bit Cone Fishing Sockets
American Steel Whipstocks
American Inside Pipe Cutter for Drill Pipe or Casing
American Fish Tail Bits

• • • • It takes good machines to satisfy the oil industry — these are doing it



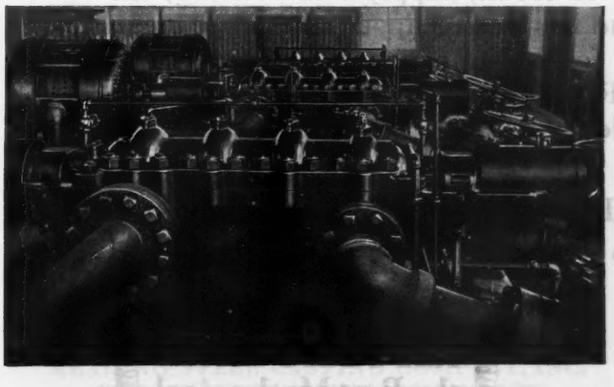
200 h.p., Type "ANY" Slip Ring Motor and Texrope Drive operating Slush Pumps.



150 h.p. "ANY" Motor driving Draw Works and Table through Texrope Driven Single Reduction Unit.

Texrope Driven Single Reduction Unit with Allis-Chalmers Motor and Control, arranged for Cable Tool Drilling.

25,000 Bbl. per day Type "M" Centrifugal Pipe Line Pumps driven by 225 h.p. Allis-Chalmers Motors.



It is in the oil fields that quality machinery shows its real worth. There is less time out for repairs or adjustments and fewer delays for getting new parts. A little extra care taken in the building of a motor or pump at the factory often saves trouble in the field.

Allis-Chalmers has always tried to build good machinery. Whether it is a 100,000-k.w. steam turbine and alternator unit or a 15-h.p. motor or Texrope Drive, each is built with enough reserve power to carry the heaviest loads.

There is an Allis-Chalmers motor and control for every oil field job, two-speed motors for pumping and drilling, special drilling motors with enclosed slip-rings and drip proof housings, totally enclosed fan-cooled motors for exposed locations, and standard, general purpose motors for driving pumps, compressors, etc.

The positive and flexible, short center, Texrope Drive is popular in all branches of the oil industry. It is used with Allis-Chalmers single and double reduction units, for operating slush pumps, pipe line pumps, compressors, and for driving many other types of oil field equipment.

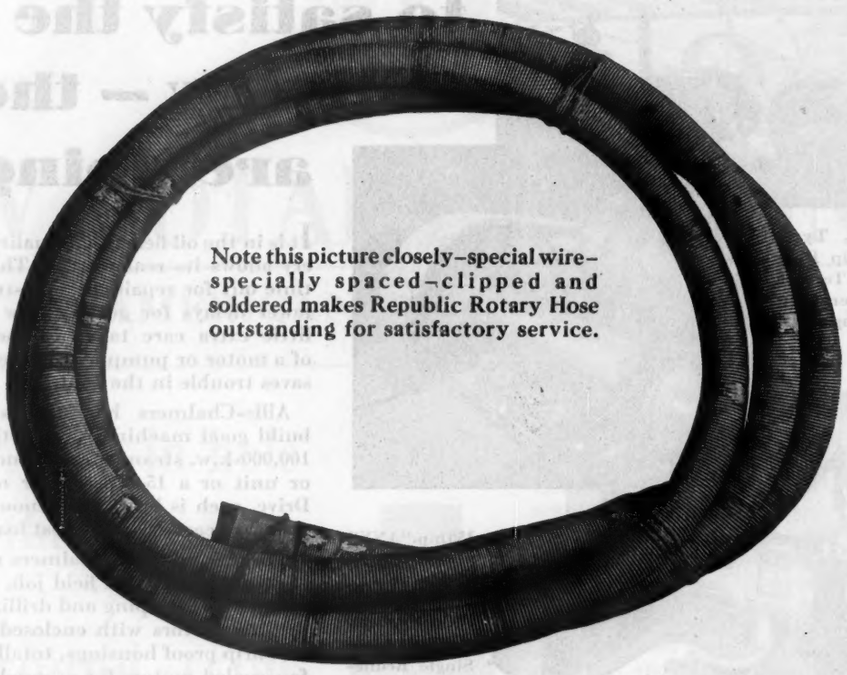
Allis-Chalmers centrifugal pumps are built for a wide variety of heads and capacities. Pipe line pumps are built in both centrifugal and plunger types. Gas engine driven compressors are suitable for use in booster stations on gas lines.

This is some of the equipment that Allis-Chalmers, as manufacturers of power, electrical and industrial machinery, builds for the petroleum industry. Write for bulletins.

ALLIS-CHALMERS MFG. CO.
MILWAUKEE, WIS.
Sales Offices in all Principal Cities

ALLIS-CHALMERS

REPUBLIC Rotary Hose



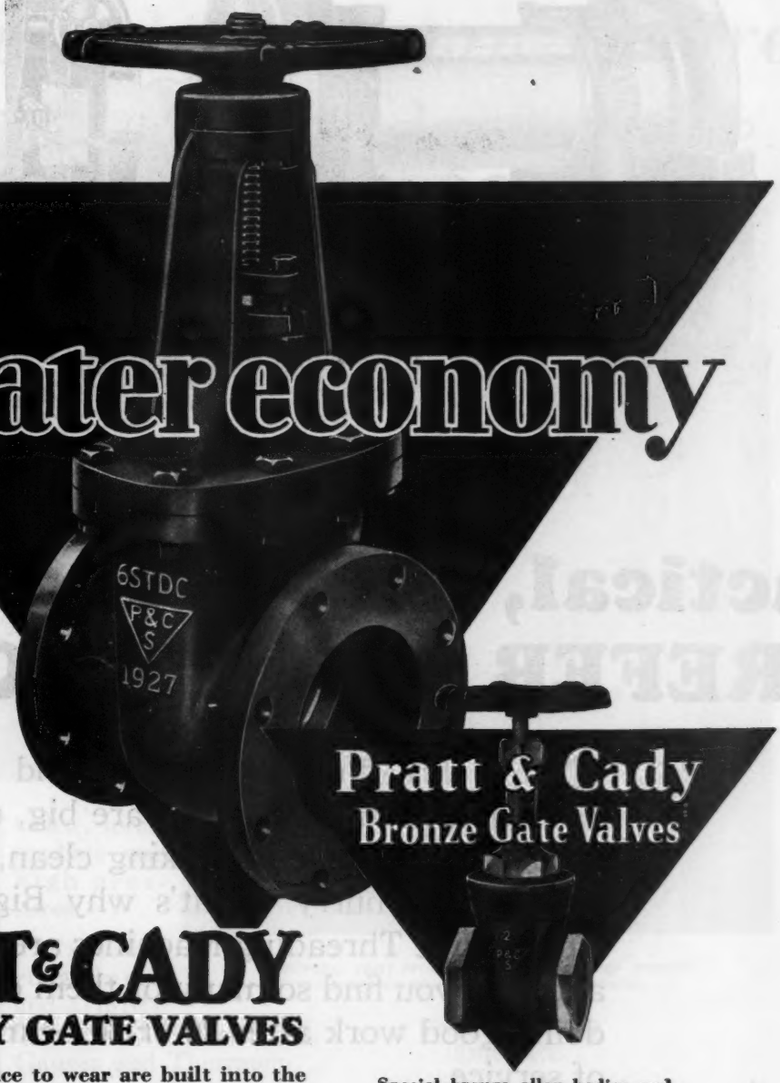
Note this picture closely—special wire—specially spaced—clipped and soldered makes Republic Rotary Hose outstanding for satisfactory service.

YEARS of active competition in all lines of rubber using industries have established for Republic a fine reputation for high quality, endurance and economy. Years of marketing have taught Republic that the Industrial Supply Distributor can best serve both consumer and manufacturer. His intimate knowledge of credit, supply and demand; his warehousing services and his well equipped sales force mean lower distribution costs for us—a saving which returns to you in better quality. Republic distributors can help you solve your rubber problems.

THE REPUBLIC RUBBER CO.
Youngstown, Ohio

BELTING -:- PACKING -:- HOSE -:- MOLDED GOODS -:- LATHE CUT GOODS

for greater economy



Pratt & Cady Bronze Gate Valves

PRATT & CADY
IRON BODY GATE VALVES

Strength and resistance to wear are built into the design and construction of every Pratt & Cady Iron Body Gate Valve. Iron parts are high test, close grained cast iron of high tensile strength.

Stuffing boxes can be repacked under full pressure. The I-beam wedge is reversible and renewable—it is guided to prevent rubbing and to eliminate undue wear under frequent operating conditions. There is full port area when the valve is wide open.

These are a few of the outstanding features of Pratt & Cady Iron Body Gate Valves. Write or wire for further information, prices, etc.

READING STEEL CASTING COMPANY, INC.
An Associate Company of the American Chain Company, Inc.
BRIDGEPORT, CONNECTICUT

Offices and Warehouses:
Boston, Charlotte, Chicago, Cleveland, Detroit, Hartford, Houston, New York, Philadelphia, Rochester, St. Louis, San Francisco, Tulsa

Special bronze alloy bodies and bonnets of compact design are unusually sound and strong.

Spindles are bronze bar stock of exceptional torsional strength.

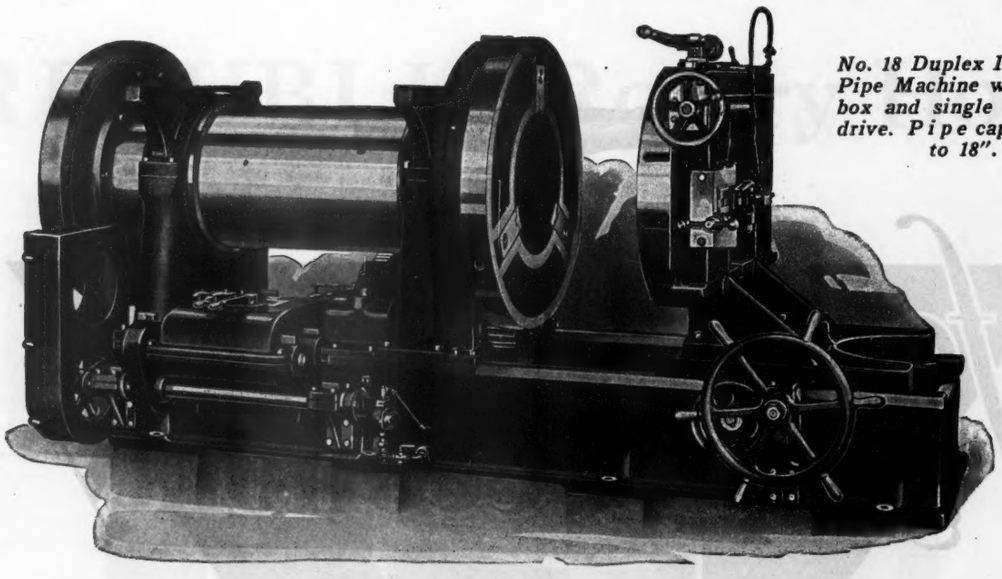
Parts are interchangeable and accurately machined—allowing easy renewal.

The wedge is reversible and renewable.

H. P. M. Drop Forged Steel Valves and Fittings are nationally distributed by the Reading Steel Casting Company, Inc.

READING *for steel*
PRATT & CADY *for iron and bronze*
specializing for quality valves and fittings
"There can be no compromise with safety"

Also stocked by the Grinnell Company of the Pacific, Los Angeles



No. 18 Duplex Improved Pipe Machine with gear box and single pulley drive. Pipe capacity 8" to 18".

Practical, Experienced Oil Men PREFER B & K MACHINES—

PIPE threading in oil fields and refineries demands machines that are big, unusually strong and capable of making clean, accurate threads in a hurry. That's why Bignall and Keeler Pipe Threading Machines are preferred and why you find so many of them on the job, doing good work after 20 or 30 or more years of service.

The Peerless dies used on B&K machines reduce friction losses to a minimum. They produce high quality threads at a low cost. B&K machines operate smoothly and cut long, tapered threads cleanly at one pass. Complete information and our latest catalog sent on request. Just write and ask for it. No obligation.

Bignall & Keeler Machine Works

of the N. O. Nelson Mfg. Co.

Edwardsville, Ill.

PEERLESS B&K DUPLEX P·D·Q·C

OGJ 12-5 Gray

Recording gas lift temperature and pressure

Continuous chart records of temperature and pressure form a permanent daily "log" of operation.

INSTALLED at the Maines gas lift station of the Marland Production Company, Mission Pool Area, the four *Bristol's Recording Instruments* shown above assist materially in controlling operating conditions.

The installation consists of one thermometer to record temperature of discharge gas, and three Pressure-Vacuum Gauges to record intake, intermediate and high pressures.

The inherent ruggedness and simple design of Bristol's Gauges and Thermometers make them especially suitable for oil and gas field use. With ordinary care they should give accurate, trouble-free service for many years.

[Catalogs, Bulletins, will be sent on request of any interested person in your plant.]

ENGINEERING SERVICE

Bristol's Engineering Service is available to you at any time without obligation. Write or wire direct to main office at Waterbury, Conn., or to nearest branch office.

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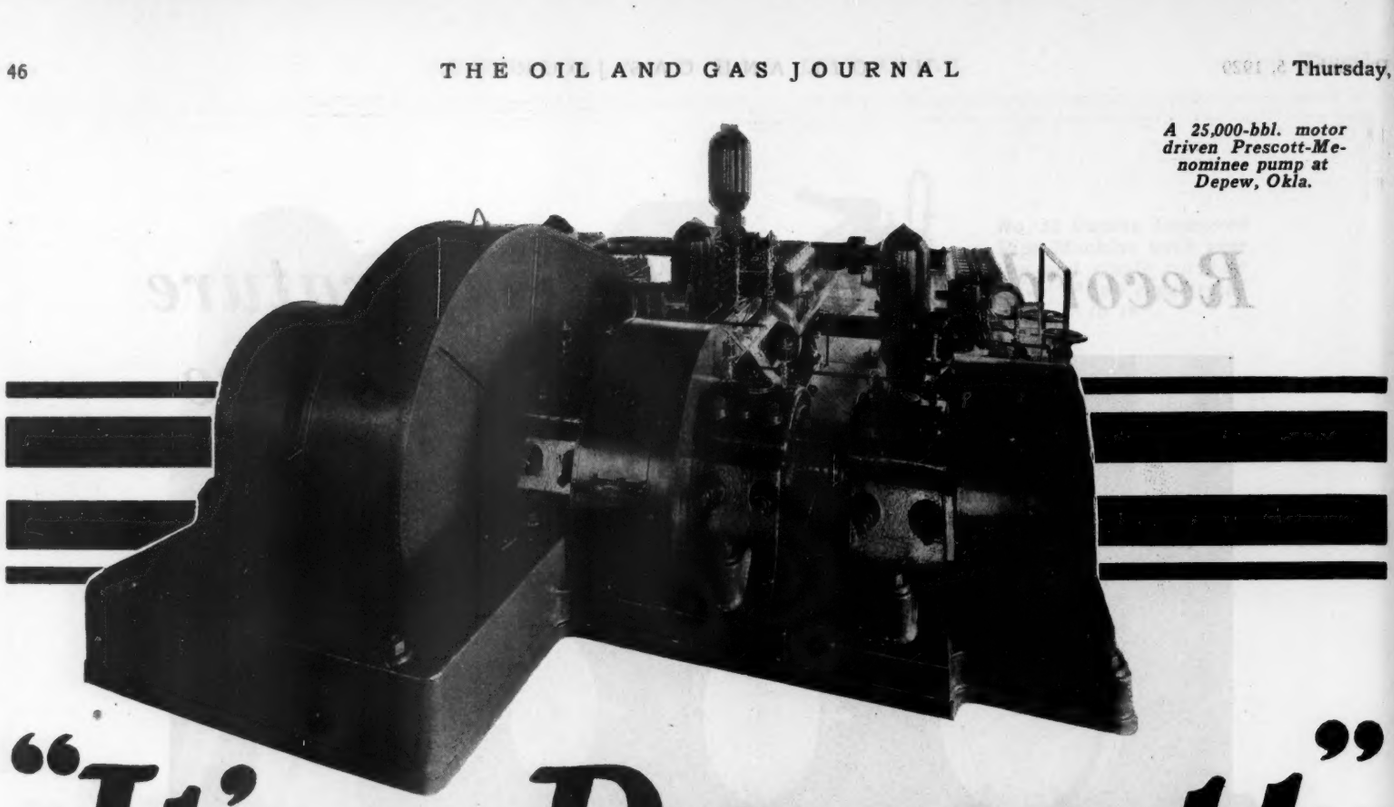
The BRISTOL Company

Waterbury, Conn.



A 25,000-bbl. motor driven Prescott-Menominee pump at Depew, Okla.

"It's a Prescott"

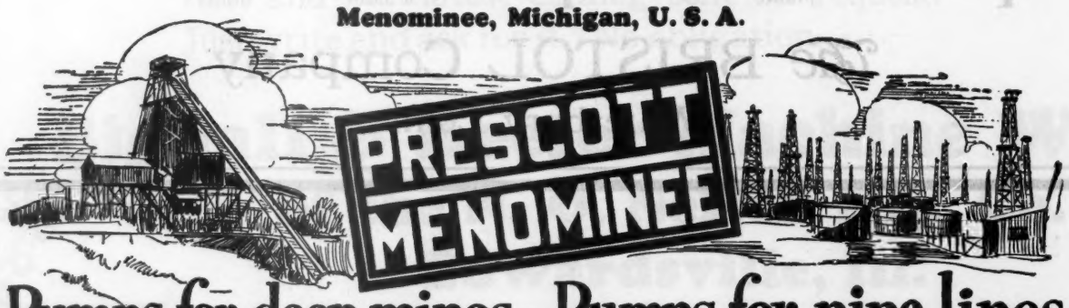
what more could any one want!

PRESCOTT pipe line pumps are built to give continuous 24-hour service 365 days a year, and to do the work most economically. It is a well known fact that for pipe line service properly designed motor driven plunger type pumps give the highest efficiency over the widest range of operation. Prescott pumps can be depended on to maintain an overall mechanical efficiency of from 80 to 86% day in and day out.

Not only the tremendous saving in power, but the ruggedness and reliability of Prescott-Menominee Oil Field Pumps have made them the popular choice of men who *know* good pumps.

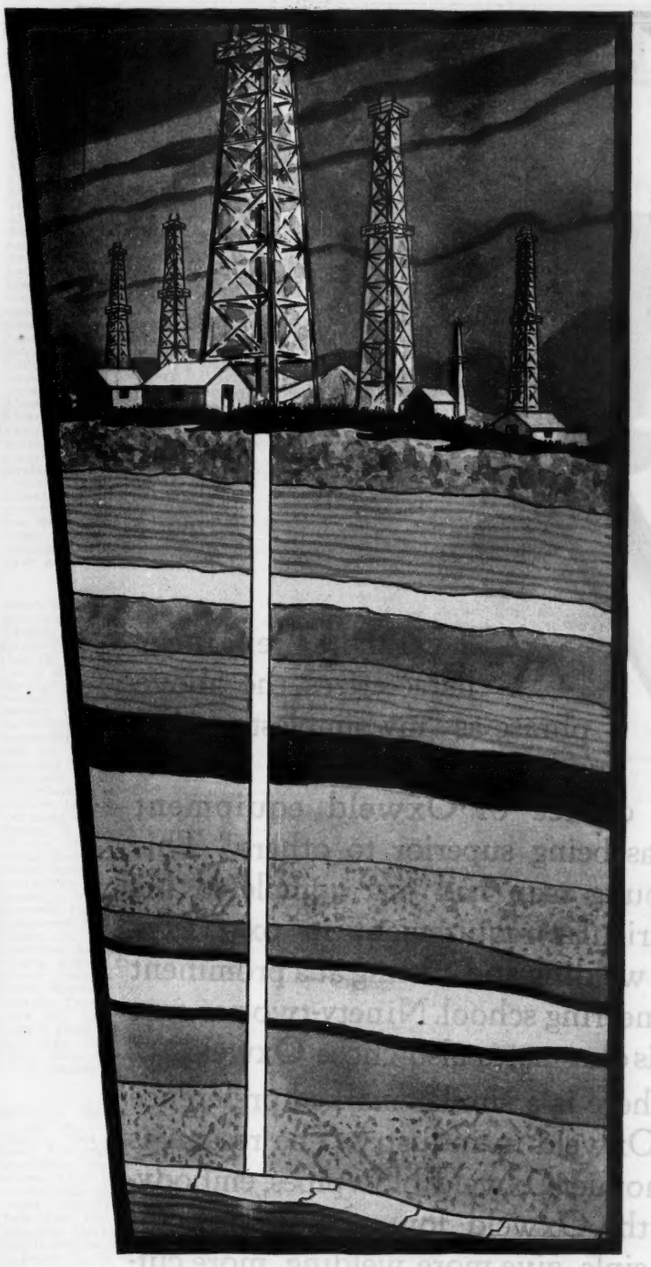
Full information and data on request.

The Prescott Company
Menominee, Michigan, U. S. A.



Pumps for deep mines ~ Pumps for pipe lines

O&GJ 12-5 Gray



Keep your bits where they belong

Working bits on the bottom of the hole mean less time consumed by expensive fishing operations and lower drilling costs.

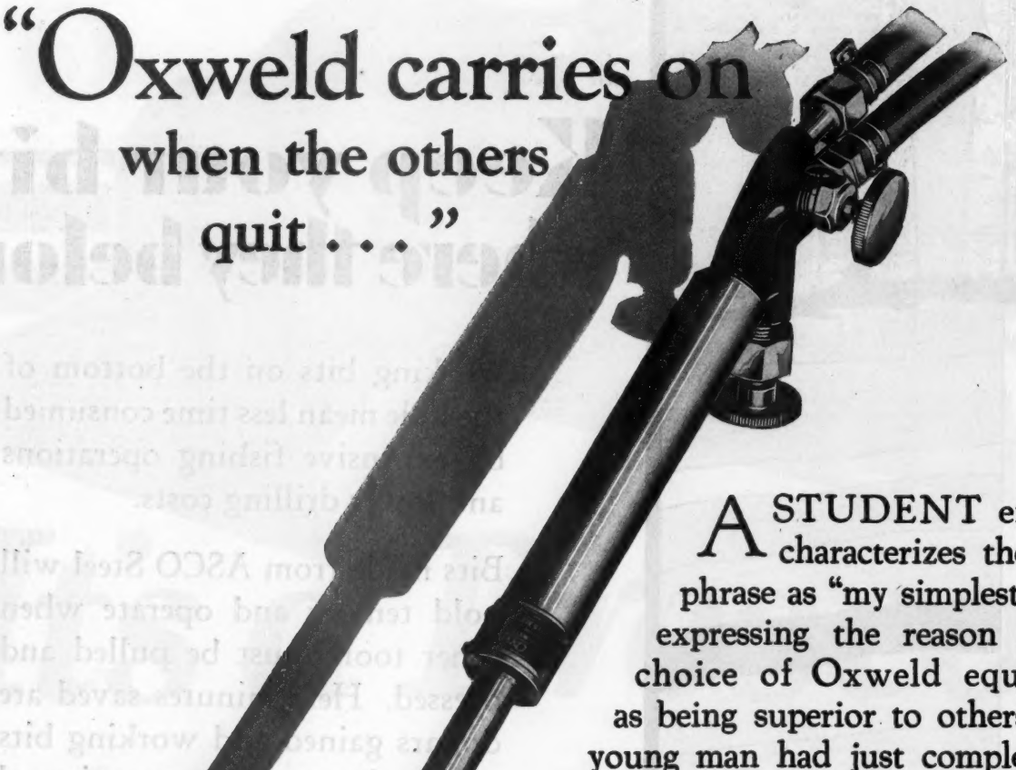
Bits made from ASCO Steel will hold temper and operate when other tools must be pulled and dressed. Here minutes saved are dollars gained and working bits are the boon of the experienced driller who is careful in the selection of steel that goes into his drilling tools.

ASCO Steel is made to withstand severe abrasion without loss of temper through the toughest rock formations.

Specify ASCO Steel for your next lot of drilling tools—keep them drilling—check the results—there is a difference.

THE ANDREWS STEEL CO.
NEWPORT ASCO KENTUCKY

"Oxweld carries on when the others quit . . ."



A STUDENT engineer characterizes the above phrase as "my simplest way of expressing the reason for my choice of Oxweld equipment as being superior to others." This young man had just completed his curricular requirement in oxy-acetylene welding and cutting at a prominent engineering school. Ninety-two per cent of his classmates also chose Oxweld.

There is a similar marked preference for Oxweld in industry. The reason is economic. Oxweld blowpipes, embodying the Oxweld low-pressure injector principle, give more welding, more cutting, more hours, months and years of operation. They carry on when the others quit.

Reliable—Economical—Long-Lived
Typically Oxweld

OXWELD
WELDING AND CUTTING APPARATUS AND SUPPLIES

OXWELD ACETYLENE COMPANY
Unit of Union Carbide and Carbon Corporation

NEW YORK
Carbide and Carbon Bldg.

UCC

CHICAGO
Carbide and Carbon Bldg.

SAN FRANCISCO
Adam Grant Building

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In Canada: Dominion Oxygen Co., Ltd., Toronto

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- ☐ Pipe Line
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Refinery Section Starts on Page 211

Preparing for Continued Proration

Highest daily average estimated total production in 1928, week ended Dec. 29, 2,585,844 bbls. Lowest in 1928, May 19, 2,338,241 bbls.

Plan Worked Successfully the First Month and Converted Important Factors in the Industry. Must Go On

By James McIntyre

Highest daily average estimated light oil production in 1928, week ended Dec. 29, 2,158,134 bbls. Lowest in 1928, Mar. 3, 1,927,713 bbls.

The first full month of curtailment of production in the flush fields of the United States has proved so successful in stabilizing the petroleum industry that there is no hesitation in extending it throughout December in all the prorated fields, and in preparing plans for continuing it through the winter months in Oklahoma. A drilling moratorium has been declared in the Elwood Field in California and two very important companies which have heretofore only partly complied with the regulations in Santa Fe Springs have joined the movement wholeheartedly.

According to the estimates of The Oil and Gas Journal for November the country produced an average of 2,633,576 barrels a day in that month. This is in sharp contrast to the unrestrained supply of production in August and September when, for five weeks, the country averaged 2,966,321 barrels a day.

November's output was over 330,000 barrels a day below the midsummer overproduction and the past week's daily average of 2,632,717 barrels is about the same as that of last January, when production was on its way upward. This almost constant upward trend was sufficient to give us a total of considerably over 1,000,000,000 barrels of crude in the 12 months ending November 30.

To properly vizualize what a billion barrels of oil means one need only recall that it took from 1859 to 1900, or a little over 41 years, to pile up the first billion barrels of production in this country. It means that we have produced in one year about one-twelfth of all the production brought to the surface in over 70 years.

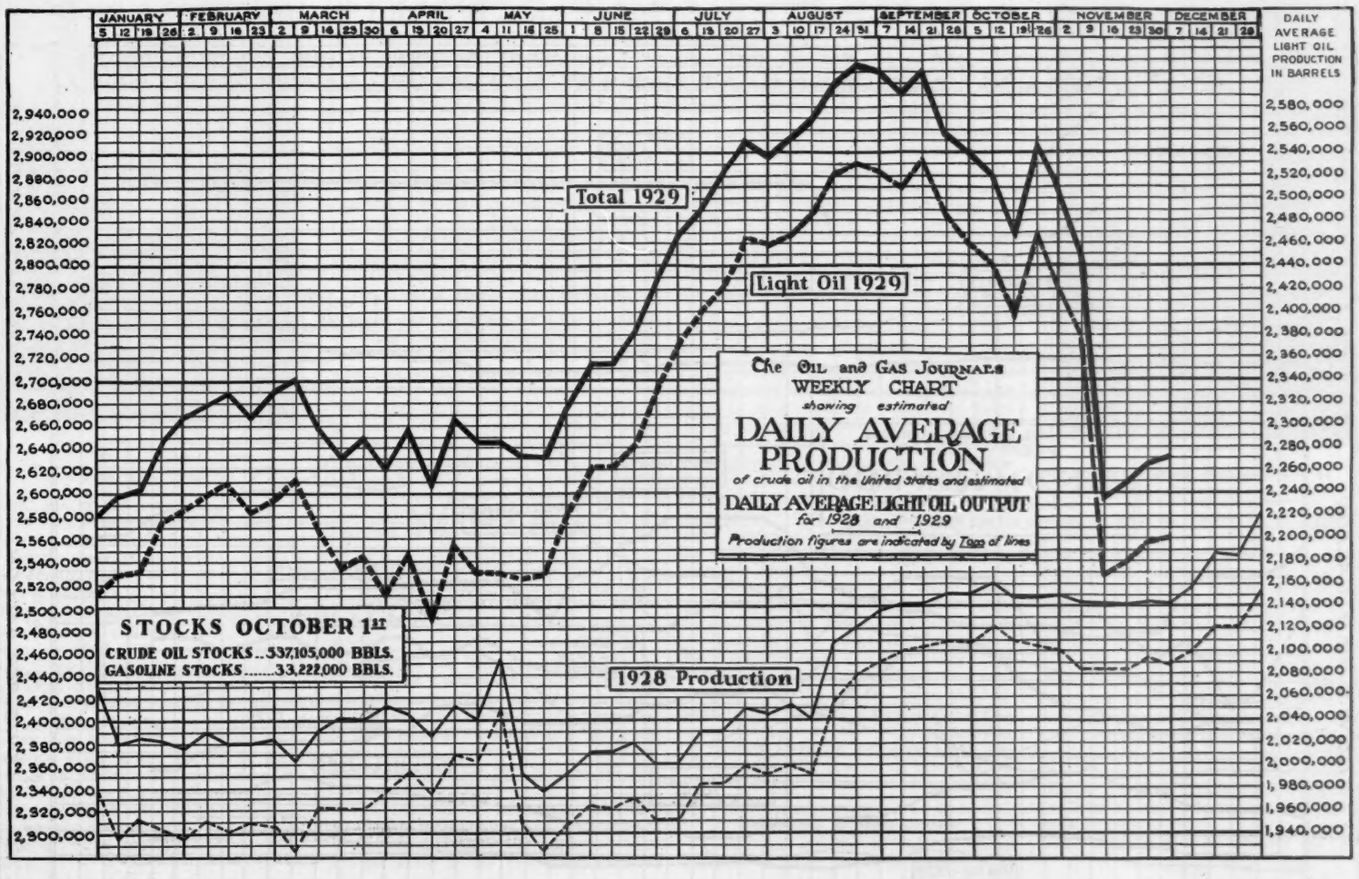
It was because of the realization that this was producing at too fast a pace that curtailment of the surplus was voluntarily engaged in. There is no reason to doubt that the fields already known and under development can greatly exceed the 1929 output if allowed to produce unabated next year, and in the closing days of this year the need for sane development is greater than ever.

PRODUCTION IN THE UNITED STATES

Estimated daily average production of light and heavy gravity oil in the United States for week ended November 30 and a comparison with the previous week follows:

	Nov. 30		Nov. 23	
	Light	Heavy	Light	Heavy
Oklahoma—				
Oklahoma City	55,660	.....	64,115	.....
St. Louis-Pearson	53,790	.....	52,560	.....
Seminole	239,850	.....	228,510	.....
Northern Miscellaneous	240,255	.....	239,340	.....
Southern Fields	58,025	.....	57,890	.....
Total Oklahoma	647,580	.....	642,415	.....
West Texas—				
Hendricks	101,745	.....	106,290	.....
Yates	146,088	.....	142,947	.....
Remainder	112,160	.....	113,914	.....
Total West Texas	359,993	.....	363,951	.....
North Louisiana	31,890	5,510	30,915	5,510
Arkansas	18,665	44,335	18,850	45,115
North Central Texas	145,680	.....	145,094	.....
Texas Panhandle	101,085	.....	102,539	.....
East Central Texas	17,807	.....	17,674	.....
Kansas	108,880	.....	110,320	.....
Total Mid-Continent Area	1,431,580	49,845	1,430,958	50,625
Gulf Coast	.....	182,975	.....	187,220
Southwest Texas	.....	58,951	.....	59,907
Eastern	133,500	.....	134,000	.....
Rocky Mountain Area	74,366	.....	71,642	.....
California—				
Santa Fe Springs	159,000	.....	160,000	.....
Long Beach	107,000	.....	108,000	.....
Huntington Beach	41,000	.....	41,000	.....
Elwood	37,500	.....	35,000	.....
Ventura Avenue	60,000	.....	54,000	.....
Seal Beach	29,000	.....	27,500	.....
Remainder of State	139,000	129,000	136,500	131,000
Total California	572,500	129,000	562,000	131,000
Total United States	2,211,946	420,771	2,198,600	428,752
Grand Total		2,632,717		2,627,352

Total Increase, 5,365 Bbls.; Light Oil Increase, 13,346 Bbls.



Oklahoma Refiners Advance Neutrals

Increase Prices 1 Cent on Higher Viscosity Grades. Other Products Generally Unchanged Except Kerosene, Which Is Lower

By C. O. Willson

Another quiet week was in prospect in Oklahoma (Group 3) at the start of the last month of the year. The fact that many refinery executives and sales managers were in attendance at the annual meeting of the American Petroleum Institute resulted in many sales offices confining their activities to routine orders. In the buying end the market is not active even in products which are considered strong and if previous history is duplicated the market will continue relatively dull until after the holiday season.

An advance in most grades of neutral oils was the only development of the past week in which important price changes were involved. The largest manufacturer of neutrals advanced prices on all the viscous grades from a half to 1 cent a gallon, the largest increase being made in the higher viscosity grades. At least two of the smaller manufacturers had already advanced their prices and it is expected that the new prices will be generally accepted by the sellers within a few days. There are only a half dozen neutral manufacturers in Oklahoma and three of these are active in the tank car market. The others use their neutrals in their own compounding and this demand, coupled with the long-time contracts, takes the entire plant output. There has been a steady demand for Mid-Continent neutral oils all year, a reflection of the greater use of paraffin base lubricants. According to the Oklahoma refiners their prices have been under those of competitors in other refinery groups.

Among the refiners the hope is expressed that the American Petroleum Institute meeting will result in a general appreciation of the fact that some curtailment in refinery operations will be necessary during the next few months if gasoline prices are to be strengthened or even maintained at their present levels. It is felt that the lead of the crude oil producers who have curtailed production in line with the refinery demand should be followed so that large accumulations of gasoline can be prevented and the current market prices advanced to the point where they will at least cover the cost of operation for a majority of the refinery operators.

Those who have investigated the situation state that in most cases refinery output of gasoline is practically the same as during July and August, the period of greatest demand from the consumers. Most operators dislike to curtail their operations because it increases their per barrel refinery cost. The attitude of the individual refiner is that any action on his part with others running capacity will not remedy the situation. Many are willing, however, to join any general move to reduce runs and it is possible that some such action will be worked out.

REFINED MARKET BAROMETER

Except for slight price changes in some of the lesser important products the refined oil market showed very little change and the trading was generally confined to routine orders. Price recessions occurred in cylinder stock and wax at East Coast refining points. The eastern gasoline and kerosene market remained inactive but marketers are hopeful that proposed export orders will materialize to strengthen that market in the near future. Neutral lubricating oil prices were advanced in the Mid-Continent, this representing the only upward turn in the total list of products. Contrary to this a few neutrals, cylinder stocks and bright stocks were lowered in Pennsylvania. Fuel oils are being actively traded and the low cold test grade is receiving the most attention because of the limited supply.

Mid-Continent—Both refinery gasoline and natural gasoline prices remained essentially unchanged and the sales were restricted to routine business. Neutrals were advanced and the light gravity and low cold test fuels were actively traded but the balance of the market was exceedingly dull.

Atlantic Seaboard—Gasoline and kerosene sales were less in volume but export orders are expected to bring about greater activity in these commodities over the immediate future. Cylinder stock and wax prices recorded slight recessions at the end of the week.

Chicago—Low cold test fuel oils and furnace oil were the only commodities actively traded, the orders for gasoline and kerosene being restricted to routine business. Slight recessions were shown for some grades of gasoline.

California—The supply of all refined oils was adequate to satisfy the lesser demand and the market settled into a routine with little change expected until after the first of the year.

Gulf Coast—Trading was restricted to small sales and no price changes resulted.

Pennsylvania—Slight price concessions were shown for several grades of gasoline and kerosene. Cylinder stocks, bright stocks and wax prices were also marked down by the close of the week.

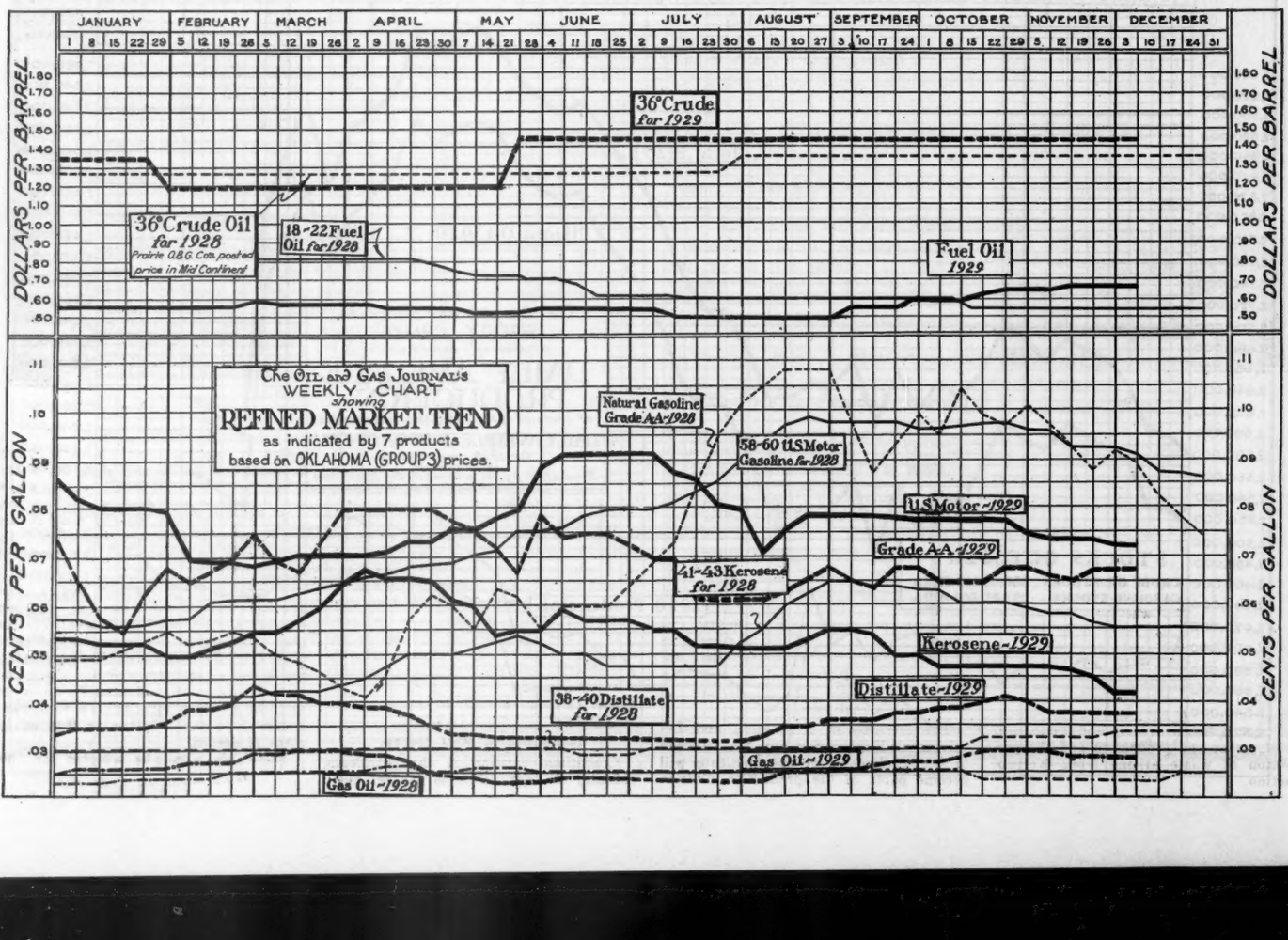
Wide Spreads

The present Oklahoma market is characterized by wide spreads in prices for most of the refinery products. This is a reflection of the fact that the position of individual refiners differs in regard to the necessity of moving plant products and in some cases it also reflects a difference in quality of material sold. It is characteristic of a somewhat muddled market that a refiner who is in a strong position in one product and quoting high prices, will have a surplus in another product and actively soliciting new business at the low of the market.

This situation is apparent not only in the gasoline market but also in kerosene and all grades of fuels. In gasoline a few refiners have sufficient retail outlets and regular jobber accounts to not only absorb their own plant output but they are constantly buying from other refiners. These refiners naturally are quoting the top of the market.

Other refiners are well taken care of in orders for high gravity grades but they are having difficulty in finding outlets for their regular grades of U. S. Motor gasoline. Sales of the latter product were being made as low as 6½ cents in Oklahoma last week and sellers competing with refiners in other areas reported that they often lost business at this low figure. At the same time there was a considerable movement to jobbers at a price range of 6¾ to 7¼ cents. The 60-

(Continued on Page 228)



Institute Approves Unitization Plan

Adopts Mid-Continent Resolution. Reorganization of A.P.I. Activities Into Three Main Divisions Proposed

By Andrew M. Rowley

CHICAGO, Dec. 3.—Culminating the year during which the greatest progress has been made by the petroleum industry in solving problems affecting every branch of the business, the largest and most representative gathering of oil men ever assembled, meeting at the Stevens Hotel here for the tenth annual convention of the American Petroleum Institute, placed its approval on what has been done to bring stabilization to the industry and voiced its determination to continue this work during the coming year.

Further steps were taken to co-ordinate activities being carried on to maintain the balance between crude oil production and consumption with efforts to extend this conservation movement to include refinery operations. In this connection it is being suggested that efforts should be made to induce the refining industry to curtail its runs to stills about 10 per cent during the first four months of next year in order to prevent a piling up of excess stocks of gasoline.

Unitization Approved

The directors approved the unitization plan presented by President W. N. Davis for the Mid-Continent Oil and Gas Association in the following resolution which was adopted by the directors:

"Whereas unit development and operation of (single) oil pools secures the maximum ultimate recovery of oil and gas; the development of the pool at a minimum cost and economical production; the most efficient utilization of the

W. R. Boyd
Executive Vice President

natural gas in the production of the oil and the elimination of its waste; and, in general, the conservation of the oil and gas and the prevention of waste attendant on overproduction,

"It is resolved by the board of directors of the American Petroleum Institute that it endorses the policy of unitization of the oil pools and recommends it to the oil industry throughout the United States wherever practicable.

"And be it further resolved by the said board of directors that in cases where unitization is found to be unattainable or impossible every effort should be made to effect a co-operative agreement between the parties interested in the potential pool to insure orderly and economical development and production and the prevention of waste arising from overproduction.

"Be it further resolved that a standing committee of this board be appointed charged with the duty of co-operating with committees of other organizations in promoting the general adoption of the unitization practice."

To Create Three Main Divisions

More direct dealing with the problems affecting the various branches of the petroleum industry with a resultant greater effectiveness in considering these problems and acting upon them is expected from the plan approved in principle by the board of directors of the Institute to create three main divisions of the Institute—producing, refining and marketing. With a main committee of 25 members headed by a vice president of the Institute, each of the three main branches of the petroleum industry will be in a better position to consider those matters affecting that particular branch of the business and to bring these matters quickly and in definite form to the board of directors of the Institute for action.

Officers of the Institute were instructed to work out a definite method for putting this plan into effect and to present this arrangement to the executive committee of the Institute for approval. Upon approval of the arrangement by the executive committee the plan will be put into effect by the Institute.

The Division of Production and Development Engineering and the Division of Standardization of the Institute will become parts of the production division under the plan. Corrosion will be considered by both the production and refining divisions and subcommittees of the general committees of these two divisions will have charge of questions relating to corrosion, each division dealing with the corrosion problems relating to that division. The pipe line industry will come under the production division.

Spirit of Optimism

The wonderful success achieved in the conservation movement during the past year to hold crude oil production more nearly to market requirements is reflected in a spirit of optimism prevalent at this convention seldom equalled at any previous gathering of oil men. The fact crude oil production has been brought into balance with consumption seems to have imbued all with the feeling "it can be done" when other questions or problems are discussed.

Representative oil men from every section of the country have stated at informal meetings here conditions in the oil business are better now than they have been in years and that there is no reason why this condition should not continue during the coming year. All appear to feel there is need now for action upon the part of the refining industry to prevent benefits accruing from stabilization in the producing branch from being lessened through overmanufacture of gasoline.

Committee to Meet Hoover

Conditions existing in the petroleum industry as they relate to general business of the country will be presented by President Hoover in Washington on December 5, when a committee representing the American Petroleum Institute will attend the meeting in Washington to consider business conditions.

Capt. J. F. Lucey, long prominent in affairs of the Institute and for many years a personal friend of President Hoover, will be on the committee representing the Institute at the Washington meeting.

Corrosion in the petroleum industry is being given considerable attention at this convention and the various views presented by engineers, pipe line and production executives and the claims of the different manufacturers of coatings, alloys and other protective measures are being given close attention and thought. Interest was manifest in the claims of German manufacturers of a spun glass that they can coat pipe and other equipment with this spun glass, which is malleable. The different types of coatings, especially for pipe lines, aluminum foil, and other methods and practices relating to corrosion are being discussed by men who have made a detailed research of the problem.

Committees at Work

Committees of the Institute on standardization of belting, steel storage tanks, rigs and derricks, pumping equipment and engines, rotary equipment, oil field boilers, rig irons, cable tool joints, and manila cordage met all day Monday and all of this evening. Considerable progress was made all along the line in refine-

Lacey Walker
Secretary

ments to existing standards. Attendance at these committee meetings taxed the capacity of the committee rooms, while the interest manifested in the matters under consideration showed conclusively operators and manufacturers alike fully realize the importance of this work of the Institute.

Standards for a 136-foot derrick were adopted. This is the first time complete standards have been made available for that size derrick and it emphasizes more than ever the trend towards deeper drilling in the oil industry and the determination of operators and manufacturers of derricks to have standardized equipment available to the industry as that equipment is needed.

Standards were also adopted for 100-

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PRESIDENT REESER'S RECORD LEADS TO DEMAND FOR HIS RE-ELECTION

CHICAGO, Dec. 3.—The petroleum industry seems unanimous in the opinion the policies carried out during the past year during the administration of Edwin B. Reeser, president of the Barnsdall corporation, as president of the American Petroleum Institute, should be continued during the coming year. And they are evidently all of the opinion Mr. Reeser is the logical man to continue this work. No other name is heard mentioned for president of the institute and every indication at this time is for the re-election of Mr. Reeser by the board of directors on Wednesday of this week.

Edwin B. Reeser

"It is a bad policy to change horses in the middle of a stream," "it is just as important and vital to the industry to maintain the co-operation now existing and to continue the conservation movement as it was to start this movement" and "well, if not Reeser, who could the industry select?" are but a few of the comments showing the trend of thought at the annual convention of the institute being held here this week.

Everyone admits the petroleum industry is in better shape now than it has been for years and all give Mr. Reeser the bulk of the credit for his untiring efforts in bringing about this condition. All realize it is asking Mr. Reeser to sacrifice much by accepting the presidency of the institute for another year and that the position entails considerable hard work, but they pass this off with "well, the industry needs him now and he ought to accept."

More Attention to Refining Branch

Much Expected From Establishment of Manufacturing Division of American Petroleum Institute. Problems to Subcommittees

By C. O. Willson

CHICAGO, Dec. 3.—Under a plan of organization which has been approved in principle by the board of directors of the American Petroleum Institute more attention will be paid to the refinery branch of the oil industry. When the plan now suggested is finally approved it will provide for carrying on the operations of the Institute in three distinct divisions, namely production, refining and marketing. With a division for refiners it is expected that a permanent organization will be worked out so that this phase of the Institute's activities will be comparable to those in the production and marketing divisions.

The plan of operation, in brief, will be similar to that followed by many of the large integrated companies which have producing, refining and marketing branches operated more or less separately although the work of all is correlated by a general management. It has been suggested that each division have 25 committeemen headed by a vice president of the Institute who will serve as chairman. Some of these committeemen will be appointed by the board of directors and others elected by the membership. All of the work pertaining to each division will be in charge of the committee membership which will report directly to the board of directors. The latter will continue to have final authority in all matters pertaining to general policies.

Problems to Subcommittees

In addition to the general committees of the three divisions there will be the various subcommittees whose activities will be centered in some particular problem. It is felt that this plan will greatly facilitate the work of the Institute and permit a wider scope in activities. With this realignment the present standardization committees and the several production committees would be a part of the production division. The code of ethics program would be a part of the marketing division. It is hoped that with the new form of organization more attention can be paid to petroleum refining. Many refinery executives and technical men have felt for some time that there are many problems within that branch which should be solved under the sponsorship of the Institute. In the past there has been no definite program and activities have been largely confined to presentation of technical papers at the annual meetings.

This matter was discussed at the first meeting of the general committee on refinery technology group Monday afternoon. E. W. Isom, vice president of the Sinclair Refining Co., who is chairman of the committee, read a report directed to the board of directors asking that formal action be taken in regard to the future status of this committee. Mr. Isom pointed out that in the past the refinery group had not known where they stood in relation to the program of the Institute. He said that their work should be greatly enlarged and provision made for a continuous program to replace the makeshift procedure of the past. Among technical men it is felt that provision should be made for an enlarged program or the worked dropped entirely so that some other organization can develop a refining division. In this connection it was stated that one of the engineering societies is planning to create a refinery division with the view of centering the activities of the refinery technology group in that organization.

In addition to the discussion of developments in refining processing it is proposed that the refinery division may be made a clearing house for matters concerned with manufacturing and utilization phases. At a meeting of Committee D-2 of the American Society for Testing Materials Monday morning progress reports were made by the several subcommittees. These reports failed to develop many points which have not been previously discussed. In regard to the melting point of wax, Dr. R. R. Matthews, chairman, said they had reports from operators some of whom are in favor of developing a standard test while others are not. The discussion brought out the contention that separate tests would have to be developed for the different grades. The opinion was expressed that the pour-point rather than a melting point was needed.

Definition of Crude Oil

One subcommittee has under consideration a change in the definition of crude oil to include the natural gasoline from which the oil was taken. Most of the membership apparently are not in favor of making any change in the definition. At a meeting of the board of directors Monday three vacancies were filled. W. M. Keck, president of the Superior Oil Corp., Los Angeles, was elected to fill the vacancy caused by the death of David L. Ewing. Oscar Sutro, vice president and general counsel of the Standard Oil Co. of California, was elected to take the place of H. M. Storey, vice president, who resigned. Mr. Storey, it is understood, expects to retire from active participation in the oil business. Clarence M. Fuller, president of the Richfield Oil Co. of California, was elected to take the place of E. L. Doheny who also resigned. Mr. Doheny, who was one of the founders of the American Petroleum Institute, stated that it was impossible to take an active part in the work of the Institute and he was resigning for that reason. It had been expected that Mr. Doheny whose term expired this year would be renominated and re-elected.

A resolution expressing regret over the death of Mr. Ewing who was an active independent operator in the California Field for 30 years was adopted by the board. A resolution of appreciation was also expressed for Messrs. Doheny's and Storey's long period of service for the Institute and the oil industry.

Oil Show in 1932 May Be Held in May

It Is Proposed to Hold International Petroleum Exposition of That Year Jointly With Natural Gas Convention

By Andrew M. Rowley

CHICAGO, Dec. 3.—There will not be an International Petroleum Exposition held in Tulsa in 1931, and the Southwest division of the Natural Gas Department of the American Gas Association will be invited to hold its annual convention and exhibit of equipment for the natural gas industry in connection with the International Petroleum Exposition to be held in Tulsa in May, 1932, if plans discussed here today by officials of the exposition and the gas association are approved at the meeting of directors of the exposition to be held in Tulsa on December 14.

W. G. Skelly

Exhibitors at the exposition have expressed preference that the big annual show of the oil industry be held in the spring instead of the fall. The management of the exposition feels that reasons advanced for the change in date are sound and that it might be better to hold the exposition in the spring when the industry is about to become more active in development work and operations than in the fall when there is a natural slackening of activities due to the approach of winter.

Plans for the 1930 show have advanced to such an extent the change in time of holding the exposition cannot be made next year. Consequently members of the executive committee of the exposition decided, if the exposition directors approve, there would be a lapse of 18 months between the 1930 show and the one following, which under the plan formulated would be held in May, 1932.

Gas Men Suggested It

At the recent annual convention of the American Gas Association in Atlantic City a resolution was adopted suggesting that the question of holding the annual meeting of the natural gas men of the Southwest in connection with the International Petroleum Exposition be taken up with the exposition management. While in Pittsburgh last week Arch W. Leonard of the exposition management arranged for a meeting here between representatives of the gas associations and members of the executive committee of the exposition who are here attending the annual convention of the American Petroleum Institute. E. J. Stephany, secretary of the Natural Gas Department of the American Gas Association; Alexander Forward, managing director of the American Gas Association, and Frank L. Chase of the Lone Star Gas Co., Dallas, represented the gas association, with William G. Skelly, president of the exposition; William B. Way, general manager; Mr. Leonard, Alf G. Heggem, D. D. Wertzberger, J. Burr Gibbons and R. C. Sharp representing the exposition.

The centers of natural gas industry activities now are generally conceded to be in the Southwest and it is admitted that the natural gas men of the Southwest will hold an annual convention each spring in addition to the annual convention of the American Gas Association held each fall (generally in October) in Atlantic City.

Exhibitors Would Benefit

It was stated at the meeting here today that exhibitors of field equipment manufactured for the natural gas industry would receive far greater benefit from exhibits at the International Petroleum Exposition in connection with a natural gas convention than they do now from such exhibits at the Atlantic City meeting.

It also was felt that manufacturers of natural gas appliances would welcome an opportunity of exhibiting at the exposition in connection with the natural gas convention and that all exhibitors would feel one such exhibition was far better than two as has been the case with meetings and exhibits held each spring by the Natural Gas Department and in the fall by the American Gas Association.

With the natural gas men determined to hold an annual meeting each spring somewhere in the Southwest and all desirous of attending the International Petroleum Exposition at Tulsa, the sense of the meeting here today was that the logical conclusion is to hold the natural gas convention in Tulsa in the spring in connection with the International Petroleum Exposition and permit natural gas supply men, equipment and appliance manufacturers to exhibit their products at the exposition.

A. W. Leonard

Housing Facilities Adequate

Mr. Skelly assured the representatives of the gas association adequate and comfortable housing facilities would be provided for all attending the natural gas convention in connection with the exposition. Other details in connection with the proposal can be worked out satisfactorily later, it was stated.

Voters of Tulsa will decide within the

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Common Sense in the Oil Industry

Creation of Association of Co-operation on Basis of Possibility of Permanent Production Urged by Sir Henri Deterding

By Sir Henri Deterding
Royal Dutch-Shell Companies*

About two months ago I was asked what would be the subject of my address to this representative gathering of American oil men. I replied, "Common Sense in the Oil Industry." Some weeks afterwards I read that a well-known professor had said, "We are rapidly approaching a time when few people can hope to have attention for their views if they state them with sober moderation." I do not suggest that this would be the case on the present occasion. But if there were any chance of it I should fervently wish that I were supplied with some of the "gas" of which there is now such a large surplus, not only in oil, but unfortunately here and there in Europe in politics, because I am very desirous of securing your attention, not from any personal point of view but with a view to securing advancement of the good of that great industry which we have all so much at heart and which is now of paramount importance to all the countries of the world, without any exception. In this regard I am thinking less of the production and of the enormous capital invested in the petroleum industry than I am of the consumer of the petroleum products who has been trained, by ample and cheap supplies of petroleum products, to look upon such supplies as a matter of course and a normal part of his life, and would now consider his life impossible (anyhow very much more complicated) without the continuance of such ample supplies at moderate prices.

Today's Outlook

I should like you to consider what is the outlook today in the petroleum trade. Although common sense would lead us during a time of threatened or actual overproduction to expend our time and money (even vast sums of money) in creating for the benefit of ourselves, and certainly also of mankind in general, new outlets for oil. We are instead forced by strenuous competition to produce oil in excess of the world's needs and to concentrate, at any rate so far as the big companies are concerned, upon creating duplications of facilities and wasting our energy, and to a large extent our cash, in creating such duplications, in spite of the fact that such duplications cannot create one single ounce of additional consumption. Too many of the newcomers in the industry (unfortunately for a great part consisting of governmental bodies) think that we are still living in those comparatively "easy" times when the "big" money in the oil industry was made in distributing the products and the individual driller-producer and/or the bigger well-owner producer was left to get as much for his oil as the distributor would allow him.

Times Have Changed

Times have changed and—what is better—fundamentally changed. True, there are still those who think that such times may come back again, but beyond the end of summer time, when we put our clocks back one hour only, is there—especially in the oil industry—any chance of setting the clock back? On the contrary, we have to go ahead faster than ever if we do not want to be left behind in the race for perfection, and what may appear as perfection today is going to give place to a very much higher standard in a few years to come.

We are living in the age of co-operation, and not only as the man in the street thinks of it, that is, in terms of co-operative stores, but in the sense of a very much higher set "co-operative aim" based on the fact that all industries are becoming visibly (as they always have been logically but too silently) interdependent. In this way the oil producer is very quickly becoming the "producing department," the oil refiner the "refining department," the pipelines, shipping, receiving installations and even the ocean-going fleets themselves representing the "forwarding department." These departments, which may be termed the "spending department," will be fed by the "collecting department" or the department supplying the public.

The idea that it might be possible that this "collecting department" could be some government or combination of buyers who will dictate to the producer the minimum with which he ought to be content so that he may keep alive is bound to be short-lived because it is entirely illogical apart from the fact that producers in the different countries are by no means agreed, and never will be, as to how much is needed for living. The whole idea is the opposite of common sense at the present time, quite apart from the fact that unless the producer is well fed he will not and cannot extend his operations. It is just this extension that the ever-increasing number of consumers require, as the consumer's chief concern is that the producer should give him security of supply so that he also may expand on a sound basis, being sure of larger supplies when he requires them. A poorly fed cow will not keep an increasing family well supplied with good milk.

I said above that we are allowing ourselves to have our energies and capital drained by duplicating facilities. In this respect too many of us look entirely at distributing facilities. I do not blame anyone for this, because it is the most apparent; but too many refineries, too many pipe lines, etc., belong to the same family of wasteful expenditure, and of course when there is overproduction at the bottom, too much is piped, too much refined; yes, and even too much shipped. Or do you think that in times of comparatively high tank-steamer freights, it is not wasteful to transport crude oil from one place to another without increasing its chances of entering into consumption in some form or other? This is not academical, but let your imagination dwell for a few moments on the amount of at least $100,000,000 which have been wasted in such duplications in Mexico.

Mexico a Warning

During 1920 to 1924, eighteen 10-inch and fourteen 8-inch pipe lines were laid with a transport capacity to Tampico of 1,085,000 bbls. of oil per day, because in those years there happened to be a daily production of some 400,000 bbls. Today there are only 98,000 bbls. daily production in that district. I do not think I am exaggerating in saying that Mexico's oil producers, taken as a whole, have to carry the burden of $200,000,000 of capital expenditure on piping and refining with the present daily production of less than 100,000 bbls. refinable crude (light) in that district.

I do not intend to blame anybody—myself included—for that expenditure, (co-operation was banned in those days) but I put this question: "What good did it do to the oil producers, to the consumers, or to that great country of Mexico?" If that wasteful expenditure had been used (instead of as it is now on scrap iron) in the development of roads or the agricultural development, do you not think that even from the oil consumption point of view we should have been far better off?

My desire is to show by this illustration that lack of co-operation is really against everybody's interests, including the consumer, and still there are countries where the opinion prevails that co-operation should be avoided at any cost as being contrary to the interests of the common weal. For the same reason in some countries oil-producing land is still split up into small plots which is undoubtedly the most wasteful of all methods of producing.

Where the Waste Begins

This is where the waste begins, and it is impossible to calculate the almost unlimited consequences of this waste on the far future. It is really a crime against civilization.

It is still not superfluous to quote an equally striking example of waste. When in old Austria in 1909 the production rose as compared with 1906 from 760,000 tons to 2,050,000 tons, refineries were born like babies. A protective import duty of $16.50 per ton of crude and refined had helped greatly to create this mushroom growth. How can the present

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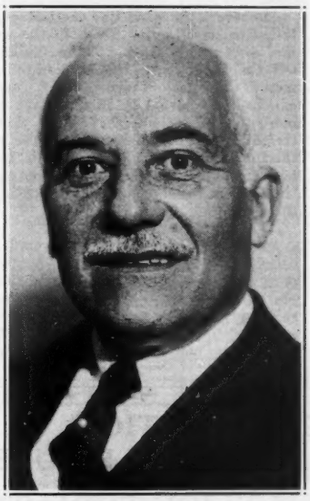
*Before tenth annual meeting American Petroleum Institute, Chicago, Dec., 1929.

RECOMMENDATION TO OIL INDUSTRY OFFERED BY SIR HENRI DETERDING

Well, first of all, conservation. Let us gradually, practically and scientifically realize what we have got and how we can draw on it liberally, not only now but in the future. That is, if we come to the conclusion that we can continue to export the excess overconsumption, to see in how far such excess is going to be lasting.



Sir Henri Deterding

Secondly, let us rather lay ourselves out to produce the best, and to spend on this the money which we should otherwise waste in duplication of facilities for distribution only. The best goods can afford to laugh at inferior goods, even in spite of superior distribution.

Thirdly, let us always bear well in mind that production, once created in a foreign country, has to be sold there, and that overproducing in and exporting from the States in order to stop such sale is the contrary of common sense. The consequence of such action is simply, in the long run, pulling down your own market against yourself to the full extent of your production.

Fourthly, let us always realize that production in a country is going to be sold in that country, whatever the price may be, and that logical government protection against cheap dumped imports is a certain event. True, in Mexico the reverse has been the case, but then unfortunately a past communist tendency was more bent on creating taxation burdens than bettering the internal condition of the country.

Fifthly, let us remember that excess of facilities must in the end raise the price of sale against the consumer on account of the large capital expenditure for our facilities, whilst the producer is charged with the odium of such high prices without having the benefit thereof.

Sixthly and lastly, let us realize that where there are several dozens of large producers and marketers, and joint action is necessary, we must sink vanity and aim at continually sound business rather than at temporarily being a big oil man with its big burdens and responsibilities.

I am simply stating a fact when I assert that when in 1902 the Dutch Indian producers joined hands, coupled with the wisdom of the policy of the Dutch government not to issue small or "split up" concessions, it was the birthday of the greatest Dutch Colonial enterprise, and when, later, the Burmah and Anglo-Persian companies co-operated in distribution, every company gained, not only the greater assurance of supplies to the clients dependent on them, but the certainty of their own bright future. In short, my advice (in which in practice I am 100 per cent partisan and co-operator) is: "Let us create an association of co-operation on the basis of possibility of permanent production with the assistance of such distributing organizations as are willing to co-operate, and do not let us worry about those who will not do so."

Operate Gasoline Line Early in 1930

Final Preparations Under Way in Changing Tuscarora Pipe Line. Great Interest in New Method of Transportation

By A. E. Mockler
New York Bureau, The Oil and Gas Journal

NEW YORK, Nov. 30.—Final preparations for the inauguration of long-distance transportation of gasoline via pipe line are now under way by the Tuscarora Oil Co., Ltd., subsidiary of the Standard Oil Co. of New York, and it is expected that the line will get into operation as a gasoline carrier by January 1, 1930. Announcement that the New Jersey company, after some experimental work, was ready to undertake gasoline transportation over long distances by pipe line, made earlier in the month, has aroused widespread interest throughout the industry regarding some of the details of the operation of the Tuscarora pipe line as a gasoline mover.

Cleaning of the Tuscarora pipe line system is now in progress. The procedure in cleaning the line follows the standard refinery practice in cleaning lines used at refineries and tanker terminals and consists of the replacing of crude oil with water, complete drainage of the water after it has been pumped through the entire pipe line, pumping of gas oil through the line to thoroughly complete the removal of water, and then the final "wash" with untreated naphtha distillate, after which the line will be in condition to flow gasoline. The various products which are now being run through the Tuscarora line during the cleaning process are being loaded on barges at the Pennsylvania terminal of the line and transported to the Standard Oil Co. of New Jersey refinery at Parkersburg, W. Va., for rerunning.

Minor Repairs

Aside from a few minor repairs, officials of the New Jersey Standard company state, there was no reconditioning problem confronting the company in the transformation of the Tuscarora line from a crude oil to a gasoline carrier.

The Tuscarora line was originally built to transport crude oil eastward to Bayonne, and the pumping system was, of course, constructed to drive the oil in an easterly direction. The only major changes necessary to reverse this flow, the company states, have been construction of three new electrically driven pumping stations. These stations are located at Bayway, N. J., Cisna Run, in Perry County, Pennsylvania, and East Freedom, Blair County, Pennsylvania. These new stations, with the use of some of the steam driven pumping stations formerly used in developing pressure for moving crude oil in the Tuscarora line, are expected to prove capable of operating the line as a gasoline carrier.

Welding of the old screw couplings in the pipe line has been found unnecessary owing to the fact that with gasoline moving through the line, the joints will have a tendency to rust and seal themselves. Experienced pipe line engineers and workers know that there is nothing more difficult to break up than a pipe line which has been used to run gasoline, company officials state, the rusting of the joints making it extremely difficult to separate the pipe. Gasoline, of course, unlike crude oil, has no lubricating content, and thus the problem of leakage at the pipe joints is automatically taken care of.

No Rerun Operation

Experiments of the New Jersey Standard and its experience in the movement of gasoline via pipe line among the network of units comprising its works in the Bayonne district of New Jersey, which involve the running of motor fuel through a 12-mile line, have convinced them that no reprocessing of gasoline will be necessary with the motor fuel which they will deliver via the Tuscarora line, and that the gasoline, upon delivery at any one of the stations along the line or at the terminal at Negley, will be in condition for immediate distribution and use. The company gets around the problem of any complications in this direction by requiring that all of the gasoline tendered them for shipment through the pipe line be of the same specification as that ordinarily moved through the line and that it be in lots of not less than 50,000 bbls.

The only change necessary along the line, aside from the establishment of the new pumping stations, will be in construction of gas-tight storage tanks at the various stations. These gas-tight tanks will be of 10,000 bbls. capacity each and will replace the present 35,000 to 50,000-bbl. tanks which have been used in the past for crude oil storage at the pumping stations. The pumping stations, under the new arrangement, will fit in ideally as bulk distributing terminals.

The capacity of the Tuscarora line when used for crude oil transportation was 25,000 bbls. daily, and while it is not yet known definitely just how much gasoline per day the line will be able to handle, it is not expected that the totals will differ widely. The capacity of the line, in barrels, does not appear impressive, but when it is figured that the line can handle 1,050,000 gallons of gasoline daily it becomes apparent just how great a factor this transportation development may become in the distribution of motor fuel.

Standard Oil Co. of New Jersey has developed the Tuscarora gasoline line primarily for its own distributive requirements, but it is not expected that the company's needs will equal the capacity of the line and it is believed that the line will gradually build up a business as a common carrier.

Expansion Plans

While conceding that the Tuscarora pipe line, as a gasoline distributing proposition, opens up tremendous potentialities in the field of distribution and pipe line development, officials of the Standard Oil Co. of New Jersey have made no immediate plans affecting the distribution of their gasoline in other territories via the pipe line method, and reports of contemplated expansion of the gasoline pipe line system into Ohio, Illinois and other markets distant from the New Jersey company's present sphere of operations are based almost entirely upon conjecture.

However, the pipe line method of distributing gasoline, as given in the schedule of traffics filed by the Tuscarora Oil Co., Ltd., with the Interstate Commerce Commission, shows that gasoline can be transported in this manner much more cheaply than the usual railroad freight rates for shipment over the same territory and distances, and this factor has commanded the attention of executives of large oil companies operating in this and other territories.

Other Lines

In some sections of the oil trade the belief is held that the New Jersey company's step in calling attention to the potentialities of pipe line distribution of gasoline opens up an entirely new era in gasoline distribution, and that the Tuscarora line will be the forerunner of a network of similar lines extending into all of the principal refining and marketing areas of the country. Aside from the important economies resulting from pipe line distribution of gasoline, there are numerous other attractive features, not the least of which is the maintenance of an assured supply at distributing points, and at all times "flowing" to bulk stations, making refiners and distributors utilizing the pipe line method of movement independent of railroad delays.

Also, in the case of pipe lines already established and suitable for looping for gasoline movement in cases where a profitable crude oil traffic is still enjoyed the problem of bulk terminals is solved by the feasibility of utilizing pumping stations as bulk plant sites, or establishing of such sites at strategic points along the line. In this manner, distributing costs can be still further cut through reducing the tank car or tank wagon transportation costs on deliveries of gasoline from bulk stations along the line to wholesale and retail distributing points in nearby territory.

To visualize some of the potentialities of pipe line movement of gasoline, it is but necessary to glance at a pipe line map taking in the principal refining and consuming areas of the United States. General utilization of existing pipe line systems, either through the supplanting of crude oil with gasoline, or through the looping of crude oil lines for gasoline transportation, would complicate to no small degree the marketing picture, notably in the eastern area. Through its utilization of the Tuscarora line, Standard of New Jersey is now in position to operate on a large scale in Atlantic Refining's home territory, and extension of the gasoline movement via other pipe lines would put Eastern refiners in a position to compete strongly with refiners in the Chicago area for a good part of the business in their territory.

Mid-Continent Situation

Successful operation of the Tuscarora line as a gasoline carrier by Standard Oil Co. of New Jersey, it is believed, may result in a revival of the plan of Mid-Continent refiners to construct such a line to carry gasoline to Chicago and other points in Standard of Indiana's territory. Railroad freights at present bar many Mid-Continent refiners from some of the most profitable gasoline consuming areas of the country, but these barriers would be largely broken down were a pipe line available for the transportation of Group 3 motor fuel into mid-western consuming markets at costs appreciably under those now involved by tank car shipments.

Another section of the country where a gasoline pipe line might conceivably operate successfully, it is believed, would be from Oklahoma to a shipping point on the Gulf, enabling Oklahoma and Kansas refiners to compete more strongly in the export trade centering at the Gulf. Freight differentials at present give Gulf Coast refiners the "edge" in this trade.

Large companies operating in competitive territory with Standard Oil Co. of New Jersey will watch with a good deal of interest the progress which the company makes in developing its distribution by way of the pipe line method. Shipping costs by pipe line transportation are such that a company moving its gasoline in this manner enjoys an initial advantage over a competitor who ships the same distance by rail. The Tuscarora line, of course, will not generally affect the marketing picture in other sections of the East, but further development of this idea, utilizing other existing pipe

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NEED FOR CONTINUED PRORATION IN OKLAHOMA SHOWN BY FIGURES

A suggested plan for the proration of the flush fields of Oklahoma in January, February and March was agreed upon at a meeting in the Mid-Continent Oil & Gas Association rooms on Saturday, November 30. Following the meeting the following official report was issued by the chairmen, C. C. Herndon for the Mid-Continent Oil & Gas Association's committee and W. C. Franklin for the operators' committee:

The Mid-Continent Oil & Gas Association having heretofore appointed a committee known as the Herndon Committee to make a survey of the supply and demand situation of Oklahoma crude oil and to make suggestions for curtailment and proration plans in the interest of conservation; and the oil operators interested in the flush pools of the state having on October 8, 1929, appointed a committee known as the W. C. Franklin Committee to assist in the conservation movement by executing the will of the operators with reference thereto; and the Oklahoma City operators having recently requested that these committees meet and prepare such plan or plans as might be found necessary to curtail Oklahoma production from and after January 1, 1930, to approximate consumption demands and said committees having investigated the subject and having met in joint session and agreed upon a plan to suggest for that purpose, beg leave to report as follows:

The Production Situation

The committees find that the potential production of crude oil continues far in excess of demand and that overproduction would now be much more serious than it is if it were not for present curtailment measures in effect in the various states. The committees further find that while production threatens to continue undiminished we are about to enter upon the period of lowest consumption of the year, namely January and February; that with particular reference to Oklahoma, the potential production from existing pools in this state for the month of January, 1930, is estimated at 799,500 bbls. per day; for February 850,000 bbls. per day and for March 922,000 bbls. per day. Estimating probable demand for Oklahoma crude in the light of the experience of past years, and having due regard for all of the probable economic conditions for 1930, we are convinced that the demand for crude from this state in January, 1930, will not exceed 650,000 bbls. per day; in February will not exceed 665,000 bbls. per day and in March will not exceed 675,000 bbls. per day. For these reasons, it appears imperative that proration in the flush and semiflush pools in the state be continued from and after January 1, 1930, to at least March 31, 1930, if wasteful overproduction is to be prevented.

The pools which it will be necessary to prorate from and after January 1, 1930, are those covered by the present order of the Corporation Commission, to-wit:

Oklahoma City, East Earlsboro, Logan County, Allen, including all producing sands, Sasakwa, Pearson-St. Louis-Asher

(Continued on Page 229)

Offers Straight Hole Drilling Theory

Mud Fluid Pressures in Bottom Joints of Drill Pipe Play an Important Part in Keeping Hole Straight and Govern Weight

By J. T. Hayward
Consulting Engineer, Tulsa*

Great progress has been made during the past few years in the technique of drilling straight holes and detecting crookedness when it occurs. Nevertheless a lot remains to be done and the tendency of the drill to deviate from the vertical requires constant vigilance, and often results in carrying weights on the bit considerably less than those that would be used if maximum footage was the only concern.

It is herein submitted that the mud fluid pressures in the bottom joints of the drill pipe play an important part in keeping the hole straight and to a certain extent govern the weight that can be safely carried on the bit during drilling. The fluid pressure referred to here is, of course, the difference between the pressure in the drill pipe and that outside it at the same level. This differential pressure, it is suggested, has a stiffening effect on the pipe that may prove to be of considerable importance.

The ratio of the diameter of a string of 6-inch drill pipe to its length in a 5,000-foot hole is as 1 to 10,000. A column of such a diameter to length ratio would tend to buckle under compression even of the lightest nature, and that a straight hole should ever be drilled with such a drill would, at first sight, appear to be surprising. It is suggested that it would in actual practice be very difficult and that the hole would be liable to go crooked whenever there was any compression in the bottom joints.

The cross sectional area of 6⅝-inch drill pipe, minus the water courses in the bit is roughly 27 square inches. Considering the case of an 11-inch bit, drill collar, etc., and a mud fluid pressure of 290 pounds per square inch at the bit acting on the cross sectional area mentioned, there would be a tension of 10,000 pounds in the last joint of the drill pipe, when the bit was just off bottom. A pressure of 10,000 pounds could therefore be put upon the bit without putting the drill pipe in compression.

Differential Pressure

There did not appear to be much reliable data available regarding the differential pressure at the bit. Pressure records at the pump are obtainable but the friction losses in and outside the drill pipe were not known. The differential pressure of 290 pounds per square inch assumed in the last paragraph was calculated from the pump speeds observed at a number of wells and the known diameter of the water courses in the bit.

Recently the writer carried out a number of tests on a well belonging to one of the major operating companies in the Mid-Continent Field and which were designed to determine the friction losses in the drill pipe and the actual differential pressure at the bit. The method adopted to obtain these pressures was as follows: The hole was filled up and the bit, drill collar, and a stand of pipe run into it. The slush pump was then started and the fluid pressure corresponding to the various pump rates noted. Neglecting the losses in the hose and drill stem, which are in any case small in proportion, these pressures are those required to force the liquid at the various rates through the water courses in the bit, and when the bit is near bottom or drilling the differential fluid pressure across it should not differ much from that found in the above manner for the same rate of circulation. The same procedure was followed at 1,500, 3,000 and 3,830 feet as a check and to obtain the frictional losses in the drill pipe and the hole. The graph, Figure 1, depicts the differential pressure at the bit at various pump speeds. The pump was 14½ inches by 7½ inches by 18 inches in good condition and the bit was a 12-inch Hughes rock bit. This graph can of course be used in any case with a bit with similar water courses and gives the differential pressure at the bit independently of the depth, the drill pipe or the size of the hole. The characteristics of the mud fluid would affect the figures to some extent and the actual weight of the mud used was not obtained but it was fairly thin.

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 5, 1929.

Figure 2

The graph, Figure 2, depicts the pressure that would have to be put up by the pump in order to maintain 300 pounds per square inch differential pressure at the bit and which would require a pump rate of 48½ complete cycles per minute. The graph refers to the same bit and pump dimensions as those previously given and the drill pipe was A.P.I. seamless interior upset pipe, inside diameter 5.96 with a nominal weight of 25.20 pounds per foot and with a tool joint on every length. The hole was 12 inches. The weight of the bit and drill collar at this well was about 5,000 pounds submerged, and with the above pump rate and differential pressure, 13,000 pounds weight could be put on the bit without putting any compression in the bottom joint of drill pipe. In the same manner at 4,000 feet a pressure at the pump of 507 pounds per square inch would be required and 560 pounds per square inch at 5,000 feet.

Pump pressures in the Oklahoma City Field range during drilling from 500 to 900 pounds per square inch at the pump and it appears, therefore, that it is quite practical to drill with 6⅝-inch pipe to 5,500 feet while maintaining some tension in the last joint of pipe and still putting a reasonable weight on the bit.

The writer has not found any records correlating the straightness of the hole with the weight on the bit and the differential fluid pressure at the bottom. The present is a plea for the inclusion of the differential fluid pressures with the other data collected during investigation on the straight hole question.

Modifications Suggested

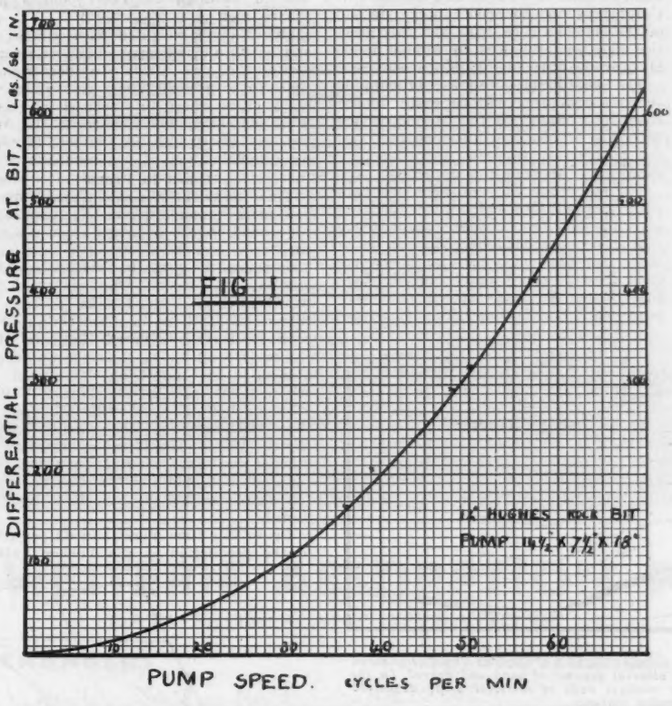
Assuming the correctness of the hypothesis outlined earlier, namely, that it is possible and desirable to drill without putting compression in the lower end of the column of drill pipe, a number of modifications in the equipment suggest themselves. It would, for instance, be important to keep the fluid friction in the drill pipe to a minimum by making the holes through the tool joints as large as practical, and possibly also stream line them so as to lose as little of the pump pressure as possible between the surface and the bit. The usual drill collars have an internal diameter smaller than that of the pipe and cause a part of the hydraulic pressure to be applied on a cross section some distance above the bit. For straight hole drilling it would appear desirable to apply the pressure at the lowest practical point, for which purpose a short section in the bit itself, or in the lower end of the drill collar, might be recessed out to a diameter as nearly equal to that of the inside of the pipe as possible.

Again, the larger the internal diameter of the lower 200 or 300 feet of drill pipe the greater the weight that could be put on the bit with any given differential fluid pressure without putting the drill pipe into compression. This condition would point to large diameter pipe with flush jointed internal couplings for the bottom stands. The outside diameter of the standard 6⅝-inch couplings is 7¾ inches, and without exceeding this figure it should be practical with flush jointed pipe to attain an internal diameter of 7 inches. With 200 feet of this pipe the differential fluid pressure of 300 pounds per square inch and 2,200 pounds due to the weight of the bit and drill collar it would be possible to put a weight of 13,000 pounds on the bit without putting any compression in the drill pipe.

Dead Weight Loads

While high differential fluid pressures may, for the reasons outlined above, prove to be desirable in the lower end of

(Continued on Page 228)



STRAIGHT HOLES MADE POSSIBLE, OTHER PROBLEMS UP FOR SOLUTION

By John R. Suman
Chairman of the Division of Development and Production Engineering of the American Petroleum Institute*

The work of the Division of Development and Production Engineering in the matter of focusing the attention of the industry on the question of drilling of straight holes has been this year's outstanding accomplishment. I believe that we have solved the question of how to drill vertical holes and have solved it to the point where several of the major companies are inserting a clause in their drilling contracts providing for a maximum deviation from the vertical of holes drilled for them by their contractors. This accomplishment shows the power this division has in attacking a problem of the industry. Also by focusing the attention of the industry to repressuring and maintaining pressure we believe we are laying a foundation for a general appreciation of the value of conservation work with resultant consideration by major corporations of the question of maintaining gas energy within producing oil structure. This should lead ultimately to a general adoption of unit operations of some character within all oil pools as it has been shown very conclusively that no real conservation work can be carried on unless each operator in a pool enters wholeheartedly into the program.

In the district meetings of our division, and more particularly in the chapter meetings, we are securing good results in the matter of urging the industry to a more general adoption of A.P.I. standards as worked out by the Division of Standardization. The reports on some of our chapter meetings are very encouraging as to the general adoption of A.P.I. standards.

The future work of this division is fairly clearly laid out in our approved list of subjects which we have listed in the order of their relative importance both for drilling and production practice. Through co-operation with the American Institute of Mining and Metallurgical Engineers Petroleum Division we are trying to pitch the programs of two societies along lines which will avoid all conflict to the end of avoiding duplication of effort.

It is interesting to note that the attendance at all district meetings held is very large while the attendance at annual meetings in Chicago is almost always relatively small. This leads us to the conclusion that some consideration should be given to a change in program

(Continued on Page 228)

*From the annual report of the chairman before the American Petroleum Institute at Chicago, December 4, 1929.

Diamond Drills Used to Complete Wells

General Outline of Practice in Canadian Fields for Drilling-In Wells in High Pressure Areas

By L. G. E. Bignell
Petroleum Engineering Editor

The Turner Valley Field in Canada is located about 45 miles southwest of the city of Calgary, Alberta, and is at present the area of largest production in the Dominion furnishing approximately 70 per cent of all the oil found in Canada.

This field presents many interesting drilling problems because of the steep dip of the formations, the irregularities of the rock structures produced by faulting, and the depth of the producing horizons, many of which are over one mile below the surface.

The producing horizon is a dolomitic limestone made up of alternating beds of very hard dense material and extremely porous strata. The harder portions of the formation serve as caprock for the gas and oil bearing portions of the structures and drilling through the caprock into zones of pressure that has run as high as 3,000 pounds per square inch presents problems that have been difficult to solve if ordinary drilling methods were followed.

Operations were begun in this area some 15 years ago by the Imperial Oil, Ltd., and others, and were due to the presence of gas seepages that have been known to the ranchers in that vicinity for many years past and utilized by the cowboys as a means of making fires to cook their meals in the open.

Use of Diamond Drill

The gas is high in hydrogen sulphide contents and that coming from the lower levels is exceedingly toxic and quite a few men have been killed by it in the past few years. This toxic condition together with the high pressure are reasons why the cable tool operations have been so dangerous when drilling in, and have resulted in the adoption of the diamond drill to this final work of bringing in the wells.

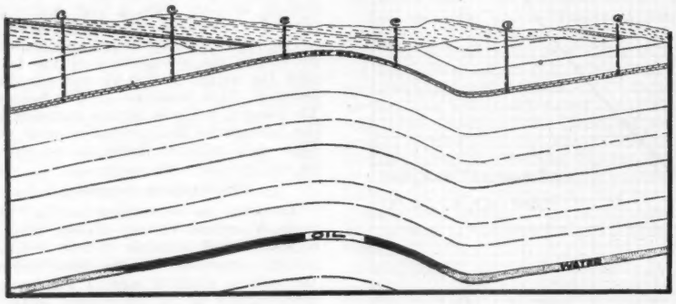
Rotary rigs have been used at many locations but even the regular type rotary has not been found suitable for completing the wells and it is now common practice to change the diamond drill at the top of the caprock to finish the well under full control.

The diamond drill has long been used in the petroleum industry for structure testing and one of the larger companies started that practice as far back as 1921 and it is now very generally used by all the major oil companies and many smaller operators for securing geological data to permit the working out of the surface structures, some of which are entirely buried under surface debris which cover all outcroppings of the key beds or markers, and in some instances the initial well has been drilled in an unexplored area with the diamond drill from the surface to the producing horizon with cores taken at intervals to secure definite information as to the subsurface formations.

A great many of the now prominent oil fields in the Mid-Continent area, as well as in California, Canada and on the Gulf Coast have been mapped through the aid of the diamond core drills and this practice has been followed in foreign fields all over the world with marked success.

The usual practice followed in mapping surface structures will be easily understood by a study of the accompanying diagrams of idealized anticline and plat and a structure wherein there is nonconformity between the geological ages.

The spacing of the test wells will vary with the conditions under which the work is being done, some cases calling for a well every quarter mile, while in other areas the core holes may be anywhere from 2 to 20 miles apart depending entirely upon the needs of the reconnaissance work that is under way.



Nonconformity. The nonconformity between geological ages and periods often eliminates surface geological work, as when there is an alluvial deposit of sand and gravel. In the above sketch the nonconformity is caused by younger beds of material being deposited over an older eroded surface.

The upper portion of these core holes being in material that is easily drilled are usually put down with the fishtail bit and water used for flushing out the cuttings and the practice of mudding the walls of the hole to prevent cavings being much the same as in regular rotary work.

When Marker Is Reached

When the marker is reached the core barrel is substituted for the fishtail bit and samples of the formation desired is secured by cutting it out of the rock by use of black diamonds or a substitute for them in the form of a steel alloy that has great hardness. The diamonds are set in the face of the core bit and the steel alloys are usually attached to the cutting surface of the bit by welding.

In either case these hard substances form a hollow ring that will cut away a portion of the rock and the central area is left inside of the hollow portion of the "core barrel" and when broken off is easily carried to the surface where it can be examined by the geologist or anyone else interested in the work.

From the lighter types of diamond drills used for very shallow depths, from 100 to 300 feet, and driven by hand or small powered engines, the manufacturers have developed the steam or air type driven machines that require from 45 to 85 horsepower for their operation and will drill holes from 3 to 18 inches in diameter and to depths of from 5,000 to 7,500 feet.

The Sullivan Machinery Co. of Chicago has been among the pioneers in the development of diamond drilling machinery and its line of equipment is now very complete and in use in practically every country in the world for prospecting for diamonds, minerals, rare earths, and petroleum.

In the Turner Valley Field these heavier type drills were called into use to solve the problems of successfully completing the wells there and combating pressures reported to range from 2,000 to as high as 4,000 pounds per square inch.

Heavy muds weighted with iron oxide and barite did not have sufficient weight above the gas strata to permit the wells to be brought under control for in many cases where this method has been tried the entire mud column in the well has been blown into the air and the wells have come in out of control.

Quick to Freeze

This gas contains some carbon dioxide and being under such high pressures is very quick to freeze any water or moisture that may be in the hole and this also makes it difficult to complete the well with mud laden fluid for the gas working through it freezes it into a column of solid ice in a few minutes.

L. H. Harris, with the Sullivan Machinery Co. of Chicago, is the authority quoted in the following description of the methods used in the Turner Valley Field in drilling these wells into production and many of the methods used should be of considerable interest to others who have similar conditions to contend with and for that reason it is felt that a recital of these facts will be useful.

Up to this time more than 65 per cent of the production in the Turner Valley Field has been brought in by the diamond drill machines of the heavier type equipped with flush joint drill pipe and the Sullivan rod brake and stuffing box.

"This production comes from holes that had to be abandoned by cable tools or rotaries for one reason or another. No wells have been drilled in the Turner Valley Field from the grass roots to production with the diamond drills although it could have been done. The reason for this is that the hoisting arrangement on the diamond drill machine is somewhat slower than the hoist on a rotary. This, of course, would be no disadvantage in outlying operations but in the rush to get to the flush oil, operators decided to use something faster—at least for the preliminary work. The Sullivan type "FK" machine is capable of handling 6⅝-inch drill pipe with a 5½-inch Kelly joint."

With this type of drilling the usual procedure followed in bringing in wells is as follows:

"The two chief factors of the Sullivan pressure control apparatus are oil saver or stuffing box, and the Sullivan hydraulically operated rod brake.

"The flush joint drill pipe passes up and down through the stuffing box which forms a tight seal around the pipe and prevents gas or oil being blown up on the derrick floor. The rod brake acts as a means of snubbing the rods or drill pipe out of the hole in case the gas pressure is more than sufficient to offset the weight of the rods or drill pipe.

"Before drilling high pressure wells in the production string must be cemented from top to bottom and it must be of sufficient weight to withstand the pressures expected with an ample margin of safety. If desired, a master valve may be put on the top of this casing at the bottom of the cellar, though this is not always done. Above this master valve is put a heavy cross. Immediately above the cross is placed another valve which might be termed a drilling valve. Above this valve is put a joint of casing the length of which is determined by the amount of room available in the cellar. On the upper end of this is placed the Sullivan hydraulically operated rod brake, and on the top of the rod brake is placed the Sullivan oil saver or stuffing box.

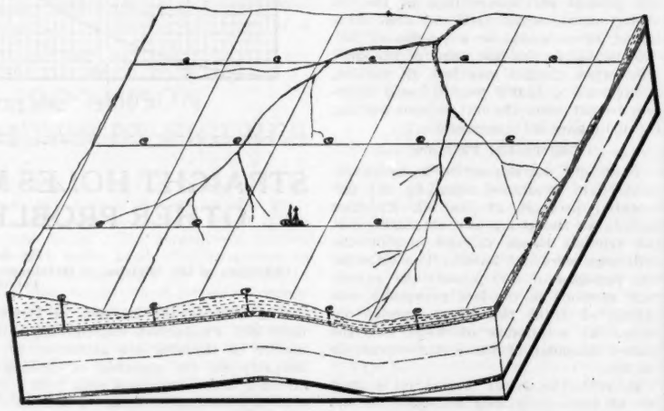
"The function of the hydraulically operated rod brake which is placed just below the floor of the derrick, is to grip the drill rods when coming out of the hole, thus preventing the high gas pressure from blowing the drill pipe out, causing a wreck. In some very high pressure wells the pressure of the gas is enough to blow the last 500 or 600 feet of rods out of the hole, unless they are controlled by this means.

"Going back to the cross in the bottom of the cellar, a high pressure valve is placed on each side outlet of the cross. One of these side outlets leads to the pump for use when it is desired to reverse circulation. The other is for use in conducting return circulation under ordinary drilling conditions back to the sump. The practice is to lead the line from this side outlet through a gas separator. The reason for this will be explained a little later.

Overcoming Pressure

"When the gas or rock pressure does not exceed 1,800 to 2,000 pounds per

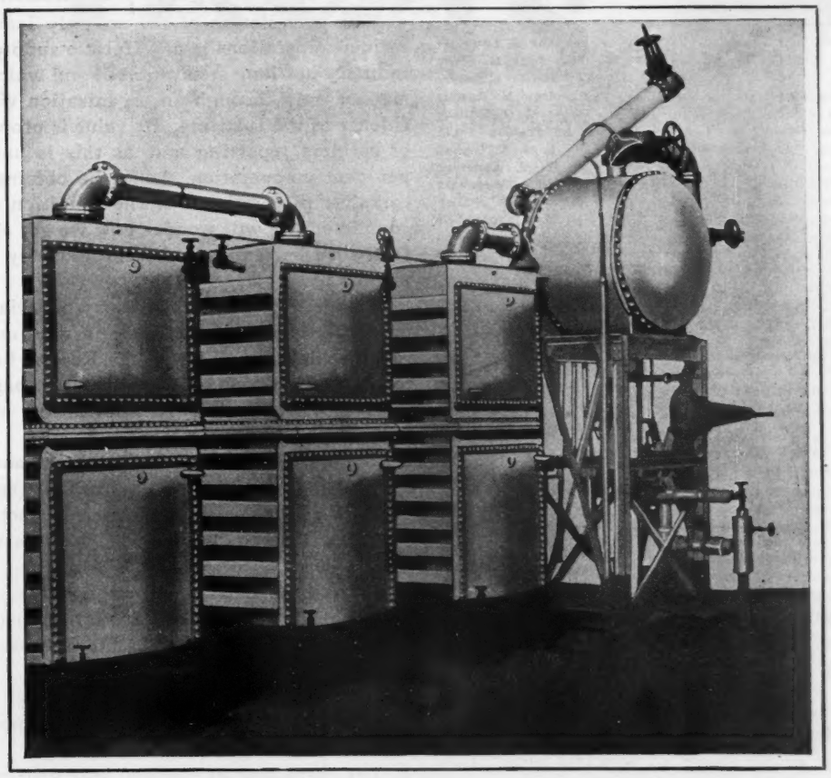
(Continued on Page 226)



Anticline and plat. Illustrating an anticlinal fold and a plat showing locations of core drill test holes, marked "c." In many parts of the country tests 50 feet deep and less are sufficient to give all the information needed.

PERFORMANCE IS THE REAL FACTOR

FIELD OPERATIONS PROVE CORRECTNESS OF ENGINEERING DESIGN



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RICH OIL	No. 1	No. 2	No. 3
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Temp. out, Deg. F	146	201	282
Pressure in, lbs. sq. in.	80	73	66
Pressure out, lbs. sq. in.	71	66	61
LEAN OIL			
Temp. in, Deg. F	175	234	330
Temp. out, Deg. F	124	176	235
Pressure in, lbs. sq. in.	150	160	17
Pressure out, lbs. sq. in.	142	150	14
Mean Temp. Diff °F	29.0	30.0	43.0
Heat Trans. Rate *or the B.T.U., per sq. ft., per hour, per degree mean temp. difference*	109.0	130.0	176.0

ABSORPTION OIL PREHEATERS

RICH OIL	No. 1	No. 2
Temp. in, Deg. F	278	279
Temp. out, Deg. F	365	366
Pressure in, lbs. sq. in.	60	61
Pressure out, lbs. sq. in.	44	45
STEAM		
Temp. in, Deg. F	382	382
Temp. out, Deg. F	382	382
Pressure in, lbs. sq. in.	185	185
Pressure out, lbs. sq. in.	185	185
Mean Temp. Diff °F	48.0	48.0
Heat Trans. Rate *or the B.T.U., per sq. ft., per hour, per degree mean temp. difference*	295.0	295.0

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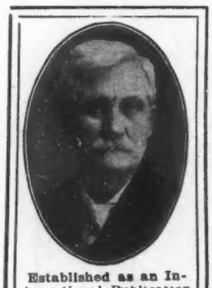

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MEMBER AUDIT BUREAU OF CIRCULATIONS

A YEAR OF ACHIEVEMENT

When the American Petroleum Institute was launched ten years ago it was with a dim hope that it would continue the co-operative spirit in the industry attained under stress of wartime necessities in the War Petroleum Board.

But it was little more than a hope because it was felt that with the cohesive pressure of war removed the traditionally individualistic and keenly competitive habits of the industry would be resumed.

Nevertheless there were practical men, like the late A. C. Bedford, with sufficient vision to foresee the necessity for making the effort, realizing that whatever amount of co-operation was gained would be to the common advantage.

So the Institute was organized with, it must be admitted, only a luke-warm loyalty from the industry at large. It took some time to overcome the suspicion that there was an ulterior purpose somewhere. It took longer to consolidate the industry behind it so that it could embark upon a definite program.

During the past five years the Institute has been feeling its way with growing confidence and authority in the industry until, during the year now closing, under the energetic presidency of E. B. Reeser and the active management of the executive vice president, W. R. Boyd, it has more than realized the highest hopes of its founders.

President Reeser's annual report, which is summarized in this issue of The Oil and Gas Journal, is a record of achievement, of constructive labor and accomplishment for the whole industry.

This has been made possible by a degree of co-operation among the units and the individuals in the industry such as could scarcely have been imagined at the time the Institute was founded. Credit for that co-operation must be given to the far-sighted leaders who have persistently pressed it forward.

The record of the Institute during 1929 is a convincing demonstration of the value of co-operation to the oil industry and to its individual units.

The tenth annual meeting of the Institute finds it at full stature, recognized and supported by the entire industry, with a year of definite progress to stimulate continued endeavor.

From appearing to be a rather idealistic association the Institute has become a very practical working organization producing tangible results in the every-day operations of the oil industry.

President Reeser stated this very plainly when he said:

"Wittingly or otherwise, the work of the Institute in most respects affects the balance sheet and the every day business life of every company engaged in the petroleum industry."

The compilation of the recently inaugurated report on weekly refinery operations is an effort to supply information of which the industry has long stood in need and which could be obtained in this manner only through an organization with the authority and confidence of the Institute. Its value is proportionate to the percentage of refiners reporting and, as this is understood, the required 100 per cent co-operation should be obtained. It is so essential to a complete picturization of the condition of the industry that, when completed, we will wonder how we got along without it. It may, in fact, then be realized why the industry came so often to fall into pitfalls.

Standardization of oil country material, one of the first programs undertaken by the Institute, is now universally recognized as a great achievement. President Reeser, however, finds it necessary to urge officers and departmental managers to take a more active interest in supporting its application, appealing especially to the executives.

The new Division of Development and Production Engineering, which Chairman John R. Suman suggests should be shortened to Division of Production to be more attractive to production men who may be a little shy of the word "engineer," has more than justified its creation.

It has been particularly designed to serve as a meeting ground for all engaged in the production industry where producing problems could be investigated and discussed by those actively interested in them.

Mr. Suman's suggestion of a more accessible annual meeting place rather than the Institute will appeal to many unable to be present at Chicago.

The correction of crooked hole drilling which has been attained has been in large measure due to the study of the problem in the district meetings of this division. Like progress is being made in the study of the use of air and gas for maintaining pressure and repressuring. The Division of Production is a logical complement to the Division of Standardization, illustrating production practice and methods.

In the matter of industrial policy the Institute has aggressively pressed two essential programs during the past year, conservation and the code of marketing ethics.

The hopes entertained with the formation of the Committee on World Production and Consumption of Petroleum and its Products have not, it is true, yet been realized. The correction of overproduction in the United States, which was a necessary initial step, was not effected in time to permit effective consideration of world conservation. But the desirability of world stabilization is more thoroughly understood and the difficulties should not be found insuperable.

On the code of marketing practices the Institute is undoubtedly making substantial progress. It is vigorously arousing and concentrating the opinion of the industry behind the code.

As President Reeser says, "Our hope for the code lies in the fact that men are sensitive to public opinion. The scorn of one's associates or of the public generally, is a sharp whip. The esteem of one's fellow men moves one more powerfully than the gain of money. That is human nature, and I ask who among you is the oil executive who will assume publicly the responsibility for breaking down the code or of preventing the other thousands who want it from making it effective?"

This is straight talk and, followed by the placing of responsibility publicly, should be successful. The industry should be able to find means to deal with "stand-pat non-cooperative executives" who persistently defy the provisions of the code approved by the Federal Trade Commission as breaches of fair trading.

The Institute is now strong enough, representing and supported by the industry at large, not only to lead but to apply its policies.

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By A. L. Strout
Standard Oil Co. of California*

As a result of intensive study and experimental work during the past few years, we have succeeded in determining principles which influence the formation of coke in the cracking process and the character of the cracked fuel oil as regards sediment. Having determined how to apply these principles through the design of equipment and method of operation, the benfits resulting therefrom have been realized to a gratifying degree with our commercial units.

Likewise, the problem of stripping cracked gas of its gasoline content, eliminating hydrogen sulphide and stabilizing pressure naphtha, offered many vexing problems. A unique method for accomplishing this was developed simultaneously with the solution of many of our other cracking problems, and is now standard equipment on our pressure cracking units. This paper is presented in two parts, and deals briefly with these important features of cracking.

Causes and Control of Coke Formation

There are two distinct methods of operating cracking plants: cracking to coke without leaving a liquid residuum, and cracking to a liquid residuum. In the latter process, it is desirable to obtain a maximum yield of gasoline, with a minimum of coke and a high quality of residual fuel.

This paper discusses the latter process, with particular stress on the causes and methods for controlling coke and sediment formation. The discussion is confined to principles. Specific data are generally omitted because they are of little significance, due to the great number of variables which will affect results. It is believed, however, that the principles presented are of general application.

Before proceeding further, it will be desirable to define some of the terms used. "Gasoline" refers to the naphtha withdrawn from the system. "Tar" defines the liquid residuum of high carbon-hydrogen ratio removed from the process. The term "coke" is used in the popular sense to designate the carbonaceous material produced in the process. A new term is introduced, viz., "ultimate tar," to describe a heavy tar which cannot be cracked further without producing coke or sediment.

Causes of Coke Formation

When an oil is subject to cracking conditions, the reaction is progressive. The products formed are gas, gasoline, intermediate oil, tar, coke, and sediment. There is evidence that all of these products are not formed simultaneously during the breaking up of an original compound. Coke formation especially appears to proceed through the stages intermediate oil, tar, ultimate tar, and finally coke; that is, coke will not be formed unless cracking is carried beyond a certain definite point, and it results not directly from the decomposition of original compounds but from the progressive cracking of the tars formed during the decomposition of intermediate oil beyond the "ultimate" stage.

Only a limited amount of gasoline can be formed in a single cracking step if coke formation is to be avoided. A large portion of the original charging stock will remain in the form of intermediate oils, which cannot be cracked further without at the same time degenerating part of the tar formed into coke. The reaction could be carried, of course, to coke and gas as ultimate products. Sediment also appears in the residuum at some stage of the process.

The amount of cracking allowable per cycle is not readily established, inasmuch as the nature of the stock entering a cycle will be an important factor. Less cracking per cycle can be permitted on stocks of high carbon-hydrogen ratio, such as topped crudes, than on light distillates if coke is to be avoided. It will also be apparent that, by reducing the amount of cracking per pass, the danger of coke formation can be quite definitely avoided. This may prove an aid in overcoming other unfavorable conditions that may exist in the cycle, such as excessive

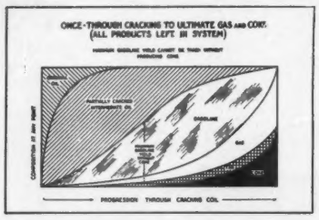

Figure 1—Process of reaction of stock through cracking zone.

metal temperatures in the heating element.

The continuous removal of ultimate tar, gas, and gasoline, as produced, would be an ideal procedure, and would entirely eliminate the production of coke and result in a high yield of light products; but this procedure does not appear practical, and other means must be sought.

An approach to the continuous removal of the products of cracking is found in the practice of cycling with the removal of tar, gas, and gasoline after each cycle.

It is evident that this practice cannot result in the maximum possible yields of gasoline without the formation of coke. This is because a small part of the gasoline produced early in the cycle will crack to produce some gas and some intermediate oils, and the final result will be a loss of gasoline by recracking. Further, the tar that is removed will consist of a mixture of fractions that could yield gasoline, and ultimate tar which, if cracked further, will produce coke. Cyclic cracking can, therefore, only approximate the ideal process in which the ultimate tar is removed continuously as formed.

Control of Coke Formation

There are two elements common to most cracking processes: the coil heating element in which a certain amount of cracking takes place, and a second element in which the cyclic cracking is continued. This secondary element may serve as a separator for liquids and vapors and act incidentally as a digester, or it may be installed primarily as a digester to promote cracking.

Coil

In the progress of the stock through the coil, the vapor and liquid are in a state of intimate mixture; and, as a result, all increments of the stock remain in the coil approximately the same length of time and are subjected to the same temperature conditions.

If a tarfree stock enters the coil and complete agitation exists, such tar as is formed will be subjected to cracking conditions the same time after its formation as the remaining fractions within this element. The average time, then, to which the total tar leaving the coil is subjected will be considerably less than that of the other fractions, including the vapors (when taken as a group). From this standpoint, the coils appear favorable for carrying out cracking reactions.

The most basic control that we have over coke formation within the coils is found in limiting the amount of cracking per pass. This limitation has already been indicated in Figure 1. The design of the furnace, however, may have a very marked influence on coke formation through its control of metal temperatures. Ample heating surfaces set in a furnace, so designed as to distribute the heat uniformly, will lower the maximum rate of heat input and result in lowering the maximum metal temperature. This condition will reduce the so-call "skin cracking," which may be a serious factor in cracking the tar content of the stock beyond the ultimate stage. The velocity of the stock through the coil will also have a considerable effect on the results by influencing the degree of agitation and, therefore, the intimacy of mixture of liquid and vapor. High velocities through the coil are evidently desirable.

Digester

The stock entering the digester carries the tar produced in the coil, and to this is added such tar as is produced by the digestion step of the cycle. If a constant temperature throughout the liquid in the digester is assumed, the degree of cracking to which the tar is subjected will depend upon the time it is held within this

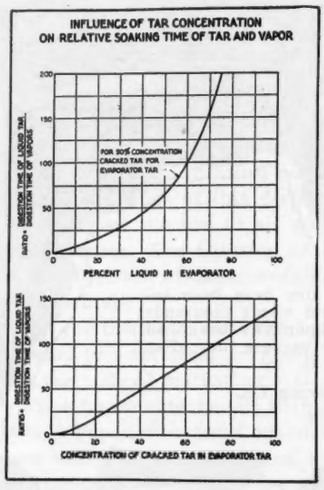
INFLUENCE OF TAR CONCENTRATION
ON RELATIVE SOAKING TIME OF TAR AND VAPOR
FOR 80% CONCENTRATION CRACKED TAR FOR EVAPORATOR TAR
PERCENT LIQUID IN EVAPORATOR
CONCENTRATION OF CRACKED TAR IN EVAPORATOR TAR

Figure 2—Top. Influence of per cent of liquid on relative time of liquid and vapor in evaporator.

Figure 3—Bottom. Influence of tar concentration on relative time of liquid and vapor in evaporator.

element. This time is greatly influenced by the volume of liquid and the concentration of the tar.

Since separation of vapor and liquid takes place in the digester, the relative periods of time of the liquid and vapor within this element will be governed by their relative volumes, densities, and rates of withdrawal. Figure 2 indicates how the liquid volume influences the relative time of liquid and vapor in the digester. This curve is based on the assumed conditions of: 275 pounds pressure, 830° F., 12 per cent gasoline and 1.2 per cent gas produced per cycle, and a total yield of 60 per cent gasoline based on fresh feed.

With a concentration of 50 per cent of tar maintained in the liquid, this curve shows that the relative time of the liquid to vapor in the digester varies from 65 to 7 as the liquid content varies from 50 per cent to 10 per cent. The concentration of tar in the liquid exerts a similar influence as illustrated in Figure 3. The curve is based on the assumption that the digester is held half full of liquid; and in this case, the relative time of the liquid to vapor varies from 65 to 3 as the concentration of tar varies from 50 per cent to 10 per cent. This marked influence of tar concentration on the relative times of the liquid and vapor in the digester is due to the fact that the quantity of stock withdrawn as liquid increases, while the quantity of vapor decreases proportionally with the decrease in tar concentration.

Figure 4 represents a group of curves showing the influence of both the liquid level and the tar concentration on the relative time of liquid to vapor in the digester. Figure 4-A shows the same group of curves on an enlarged scale to facilitate reading the smaller values. The time the tar content of the stream entering the digester will be held under cracking conditions is in accordance with these curves. The tar formed progressively within the digester will, of course, be subjected to cracking for a shorter period of time which, on the average, will approximate one-half that of the tar originally present.

It is evident that relative time conditions existing within the coil cannot be readily approached in the digester. A reduction in the size of the digester will exert a beneficial influence by reducing the actual time—and degree to which the tar is cracked—by throwing more of the burden upon the coil. High pressures on the digester will tend to correct the unfavorable conditions by increasing the density of vapors and making it possible to maintain lower concentrations of tar by the liquefaction of lower boiling fractions.

Two factors that enter and modify the

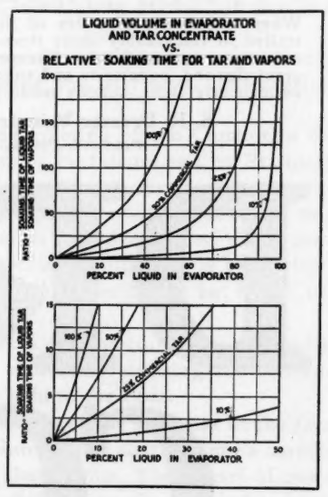

Figure 4—Top. Group of curves showing influences of per cent of liquid and concentration of tar on relative time of liquid and vapor in evaporator.

Figure 4-A—Bottom. Same as Figure 4 with enlarged scale to magnify the lower values.

apparent results illustrated in Figures 2 to 4-A must be taken into consideration: First, the liquid in the digester is actually lower in temperature than the vapor, and the relative degree to which the tar is cracked will, therefore, be correspondingly less. Second, the liquid is in a state of agitation, with the result that some of the stock is discharged soon after

(Continued on Page 229)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 4, 1929.

You can sometimes fool the automobile driver but never the automobile engine

Whatever pleases the engine pleases the motorist too, for it makes driving pleasanter It brings the motorist back for more It builds gallonage

Dubbs cracked gasoline tickles the engine When the engine says a gasoline is good, it *is* good —there's no mistake about it

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Universal Oil Products Co
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THE OIL MAN'S CALENDAR

December 2-5—Chicago, tenth annual meeting, American Petroleum Institute.

December 2-3 — Washington, D. C., convention, National Council of State Legislators.

December 2-4—Asheville, N. C., annual meeting, American Institute of Chemical Engineers.

December 4-7 — Washington, D. C., convention, American Mining Congress.

December 5-6—Indianapolis, Ind., meeting, Indiana Petroleum Association.

December 11-13 — Omaha, Neb., convention, Nebraska Independent Oil Men's Association, Paxton Hotel.

December 12-13 — Washington, D. C., ninth annual meeting, Highway Research Board.

December 16-17 — Washington, D. C., American Pharmaceutical Manufacturers Association, Hotel Washington.

January 4-11—New York, National Automobile Show, Grand Central Palace.

January 11-18 — Atlantic City, N. J., convention, American Roadbuilders Association.

January 21-24 — Detroit, Mich., annual meeting, Society of Automotive Engineers.

January 25-February 1—Chicago, National Automobile Show, Coliseum.

February 19-21—Columbus, Ohio, Ohio Petroleum Marketers Association, Deshler-Warwick Hotel.

March 19-21 — Detroit, Mich., convention, Michigan Oil Men's Association, Statler Hotel.

March 20-22—New Orleans, La., American Association of Petroleum Geologists.

April 7-12 — Chicago, annual meeting, American Oil Burner Association, Stevens Hotel.

Late Fields

WEST TEXAS—PANHANDLE

FORT WORTH, Tex., Dec. 3. — The Shell Petroleum Corp.'s No. 1 Owens, the deep pay well of the Shipley Pool, NE cor., Section 16, Block 5, H.&T.C. Survey, Ward County, is still shut down at 2,918 feet. After standing seven days the hole filled 1,800 feet with fluid of which 7 bailers were water; swabbed 55 bbls. of oil, swabbing down to 1,800 feet off bottom.

In Hutchinson County, the Travelers Oil Co.'s No. 2 Cockrell, SE cor., Section 8, Block B-3, D.&S.E. Survey, is now being put on the pump. It was shot with 120 quarts at 3,010-39 feet and was later given a second shot of 30 quarts at 2,978-83 feet, and swabbed 140 bbls. of oil the first 24 hours after this shot.

In Archer County, Duke and others' No. 1 Richardson, Section 24-25, T.E.& L. Survey, swabbed 200 bbls. in 12 hours from oil sand encountered at 1,410 feet, total depth 1,417 feet. This is a slight extension to McGargle Pool.

In Winkler County Brashara's No. 2 Brashara, SE of Section 17, Block 3, had a gas blowout at 1,360 feet in anhydrite. This is an extraordinary feature in this area of West Texas.

NORTH LOUISIANA

SHREVEPORT, La., Dec. 3.—Opened one turn, or about a quarter wide open, for the benefit of a group of major company executives, R. L. Gay's No. 1-A Bowman-Hicks, Section 34-8-12, Sabine Parish's phenomenal gusher, was estimated to be good for at least 7,000 bbls. a day, or about three times what original conservative estimates gave it. Pinched in to a quarter-inch choke it is flowing into earthen storage and no accurate gauge has been made. The Standard Pipe Line Co. is rushing completion on a 4-inch line from the Shreveport-Baton Rouge main line to handle the production and meanwhile leasing is active with prices steadily mounting. A number of offset wells are talked of but no locations have been staked so far.

GULF COAST

HOUSTON, Tex., Dec. 3.—The Texas Company's No. 25 Arnold on the west

(Continued on Page 231)

Wilbur Reiterates Need for Conserving Petroleum Resources

WASHINGTON, D. C., Dec. 2.—Accepting an estimate that the present volume of crude oil production will begin to shrink within the next decade because of the limited supply available, Secretary of Interior Ray Lyman Wilbur views with extreme alarm the oil conservation situation throughout the United States in his annual report for the fiscal year ending last June 30, sent to President Hoover today.

"The time has come when conservation of the Nation's oil resources must be regarded as a national strategy to be settled by agreement of interests across the table top, rather than by conflict thousands of feet under the ground," he declares, echoing the feelings of the President expressed shortly after he took office last March.

With the decade estimate still in mind, Secretary Wilbur is willing to accept the responsibility of attempting to solve the conservation problem during the present administration, saying, "mishandling of a great exhaustible national resource will stand out more and more clearly as the supplies are diminished, and the diminishing character of these supplies makes this a time of peculiar responsibility in their administration. The present conservation policy will be continued."

Secretary Wilbur in his report reiterates largely the stand taken by the President when he ordered cessation of further prospecting permits on government owned lands and called for co-operation in his petroleum conservation drive from the various states and private companies interested.

High Spots in Field News

NORTH LOUISIANA

Zwolle well estimated at 7,000 bbls.

KANSAS

Another wildcat showing in Sedgwick County.

EAST CENTRAL TEXAS

Second well in Van Pool drilling in with slush pit covered with oil.

CALIFORNIA

Curtailment now being fully enforced in California. Moratorium at Elwood.

ROCKY MOUNTAIN AREA

Nine operations in Lea County, New Mexico.
Drilling resumed on Moffat Dome, Colorado.

SOUTHWEST TEXAS

Starr County has promising well.
Dozen tests at Darst Creek. New gas well in Bee County.

GULF COAST

Wildcat on Moss Bluff Dome, Southern Liberty County, and test on Genoa prospect in Harris County attracting attention.

The Texas Company's 2,500-bbl. well, No. 25 Arnold, revives interest in West Columbia area.

WEST TEXAS

Slight extension to McGargle Pool, Archer County.

Brashara's No. 2 Brashara, Winkler County, had gas blow out at 1,360 feet in anhydrite, an unusual feature in that area.

Howard-Glasscock Counties area extended 3 miles westward.

Gas showing in Andrews County.

OKLAHOMA

Indian Territory Illuminating Oil Co.'s No. 2 Watters, Oklahoma City Field, blew in making 62,000,000 feet of gas and 1,199 bbls. of oil in first 16 hours.

McClain County wildcat flows 290 bbls. and extends producing area 8 miles southwest of old Asher Pool.

I.T.I.O. company's No. 2 Fortson-Farley, Oklahoma City Pool, flowed 1,960 bbls. in 65 minutes.

DARST CREEK, TEXAS, FIELD WILL BE PRORATED TO CURRENT NEEDS

By Neil Williams

HOUSTON, Tex., Dec. 2.—All but one of the companies and individuals holding acreage in the Darst Creek area of Guadalupe County have signed or agreed to sign the contract which will put into effect the plan which has been under consideration for several weeks to limit the production of the field to the market outlook.

Although one major leaseholder has not agreed to the plan, the other operators are proceeding with the machinery to put the plan in operation immediately.

At a third called meeting of operators of the district at The Texas Company's offices at which everyone present expressed approval of the curtailment program and promised co-operation, an advisory committee consisting of F. C. Sealey, assistant general manager of production of The Texas Company, chairman; John R. Suman, director of the Humble Oil & Refining Co., and K. C. Baker of the United North and South Development Co. was selected to carry out the plan, and the employment of H. H. Fitzpatrick as pumpire was approved.

Mr. Fitzpatrick, who previously has worked in similar capacities in other flush fields of Texas, being special supervisor in Winkler County, will establish offices immediately either in Luling or Seguin, and already has been provided with a car and secretarial and other assistance. Mr. Fitzpatrick's familiarity with flush conditions in the other fields and his work from December, 1920, to April, 1929, as deputy supervisor for the oil and gas division of the Texas Railroad Commission working in nearly all the fields of North Texas, Panhandle and the Permian Basin with his previous connections with The Texas Company and other companies probably will facilitate the operation of the Darst Creek curtailment program.

Under the plan as agreed to after several snags were met which threatened for a time to cause its abandonment. Darst Creek daily production will be limited to the daily market outlet on a basis similar to that which has been used in Winkler County, Yates County and other West Texas fields, virtually the only difference being that the units at Darst Creek, because of smaller ownerships, will consist only of 20 acres. With the determination of the market outlet of the field, 50 per cent of that amount will be allowed to be produced by equal allotments to each unit, while the remaining 50 per cent will be prorated based on the ratio of the daily potential production of each unit. At present there is no "nominated" pipe line outlook for Darst Creek and will not be until January 1, when it is expected two lines, one by the Humble Pipe Line Co. and the other by the Texas Pipe Line Co., will be put into operation. Each of these companies has nominated to take 5,000 bbls. daily and unless another outlet is provided by that time the daily production of Darst Creek will be held to 10,000 bbls., not counting the production of the one operator who so far has not lined up with the plan. Prior to January 1, because of there being no pipe line outlet except a short line which runs the production of The Texas Company to loading racks at Sullivan, there will be no active development of the field from a production standpoint.

GULF COAST REFINED MARKET FAIRLY STEADY

HOUSTON, Tex., Dec. 3.—The demand for Gulf Coast pale and red oils the past week was none too brisk and sellers at the opening of this week were content to hold quoted prices on all grades, although some shading of prices continues to be done with distress material appearing at times. This situation remains somewhat improved and what business is being done seems to be at fairly steady prices. Fuel oil and gas oil were unchanged the past week. Gas oil is firm and fuel oil is being held firm in price, although no new demand is appearing.

A.P.I. WEEKLY REFINERY STATISTICS

The weekly report made to the American Petroleum Institute on refinery statistics—crude runs to stills, gasoline stocks and gas and fuel oil stocks—for the week ending November 30 follows:

	(1)	(2)	(3)	(4)
East Coast	100.0	3,390,400	4,641,000	8,537,000
Appalachian	90.7	590,500	997,000	828,000
Indiana, Illinois, Kentucky	98.6	2,061,900	4,461,000	3,936,000
Oklahoma, Kansas, Missouri	88.0	2,039,100	2,753,000	3,846,000
Texas	90.3	3,678,700	5,545,000	14,114,000
Louisiana and Arkansas	95.2	1,210,700	1,694,000	4,885,000
Rocky Mountain	92.9	413,100	1,851,000	1,000,000
California	99.3	4,366,100	14,196,000	109,311,000
Total United States	95.1	17,750,500	36,138,000	146,457,000
Texas Gulf Coast	99.4	2,902,000	4,635,000	10,903,000
Louisiana Gulf Coast	100.0	855,800	1,476,000	4,141,000

(1) Per cent refinery capacity represented. (2) Crude runs to stills. (3) Gasoline stocks. (4) Gas and fuel oil stocks.

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REEVES & SKINNER MACHINERY CO.
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E. L. WILSON HARDWARE COMPANY
Beaumont, Texas

I. T. I. O. Has Another Great Gusher

New Well in Oklahoma City Pool Made 1,960 Bbls. in 65 Minutes. Now Shut In. New Proration Percentages

By W. A. Spinney
Staff Correspondent, Oklahoma Fields

The production in Oklahoma shows an increase this week of approximately 5,000 bbls. daily. The total daily average for the State amounted to 647,500 bbls.

Magnolia Petroleum Co.'s No. 1 Young, NE cor. NW NW, Section 22-21-2w, Noble County, made four flows of oil which were estimated to total 50 bbls. in one hour from 5,100-04 feet. The producing horizon is thought to be the Misener sand. This new well is located in the old Bu-Vi-Bar Pool, which had several producing wells in the 1,900-foot sand and a gas well at 2,300 feet. But it soon faded out when several dry holes were drilled.

1,960 Bbls. in 65 Minutes

Indian Territory Illuminating Oil Co.'s No. 2 Fortson-Farley, NE cor., Section 24-11-3w, Oklahoma City Pool, flowed 1,960 bbls. in 65 minutes when it blew in Saturday, November 30. The well was shut in because of lack of pipe line facilities. It was also estimated to be making 40,000,000 feet of gas. The well was producing from a total depth of 6,525 feet in lime. Six-inch casing was landed at 6,062 feet. The test is expected to remain shut in for several days until tanks can be erected, after which it will be produced for 23 hours before being shut in for the proration period. It is the second largest producer in the field to date.

New Proration Percentages

The new proration program went into effect December 1 and will continue until December 31, inclusive. The Oklahoma City Pool and the East Earlsboro Pool will be curtailed 50 per cent of the potential and the balance of the Seminole area and Logan County will be curtailed 25 per cent of the potential.

Some time this month the Oklahoma Corporation Commission will be petitioned to extend the proration period to March 31 inclusive.

Oklahoma City's Potential

The potential production of the Oklahoma City Pool is a very interesting problem. The 27 A and B wells were permitted to flow wide open on November 30 and in 24 hours produced 107,486 bbls. In addition to these 27 wells there are 13 wells shut in which have been permitted to flow only 24 hours each and have since been shut in. The combined initial production of these wells was 142,065 bbls. What they would have done the second 24 hours there is no way of knowing. Their initial production combined with the actual production of the A and B wells would total close to 250,000 bbls. but if the whole field were permitted to flow wide open, say for a week's time, this figure might be very considerably reduced before the end of the seven day period.

Following is the initial production of the wells shut in at the Oklahoma City Pool:

Company, farm—	Bbls.
Sinclair, No. 3 Stamper	3,454
I. T. I. O., No. 2 G. Button	15,983
Prairie, No. 3 Hiddleston	6,695
Coline, No. 3 Olds	12,192
I. T. I. O., No. 1 Thomas Fuzzell	42,557
Mid-Kansas, No. 1 Browning	11,575
I. T. I. O., No. 2 Trosper	19,722
Coline, No. 2 Olds	4,689
Mid-Kansas, No. 4 Fortson	3,242
Mid-Kansas, No. 5 Fortson	6,256
Sinclair, No. 2 Kinter	7,565
Mid-Kansas, No. 1 Mollman	1,500
Sinclair, No. 1 School Land	6,635
Total	142,065

During the last week and ending November 29, six new locations were staked in the Oklahoma City Field, which also has 148 drilling tests, of which 102 are below 5,500 feet, 33 are below the 6,100-foot level, and most of the latter are expected to be completed in the next 30 days. It is expected about 45 wells will be producing on its first anniversary which is December 4, 1929, with a potential production of 250,000 bbls. oil daily, and 40,000 bbls. of water daily.

Mid-Kansas Oil & Gas Co.'s No. 1 Mollman, SE cor., Section 23-11-3w, made 1,476 bbls. the first 24 hours, from a total depth of 6,400 feet, and is shut in for the proration period. It extends the production in the pool a half mile west. Five of the new locations staked last week were in the vicinity of the above well. The other location was the Sinclair Oil & Gas Co. and Amerada Petroleum Corp.'s No. 5 Kinter, SE cor. NE SE, Section 30-11-2w.

On November 29, two wells that have been shut down for the proration period were opened for production. Indian Territory Illuminating Oil Co. and others' No. 2 G. Button, SW cor. NW SW, Section 19-11-2w, was opened and started to show 2 per cent water. It made around 15,000 bbls. of oil. The other well opened was Sinclair Oil & Gas Co.'s No. 3 Stamper, SE cor. NW, Section 30-11-2w, which made 3,500 bbls. of oil.

The average production of the Oklahoma City Field for the week ending November 27, was 64,454 bbls. The gauge by companies and leases was as follows:

Company and lease—	Wells	Bbls.
Coline, Olds	3	3,283
Cromwell, Trosper Park	1	1,829
I.T.I.O., B. Anderson	1	3,490
I.T.I.O., A. Bodine	1	1,023
I.T.I.O., S. Bodine	2	1,100
I.T.I.O., But on	2	1,652
I.T.I.O., Fuzell	1	10,806
I.T.I.O., Henning	1	1,748
I.T.I.O., Johnson	1	2,585
I.T.I.O., E. Joyce	1	14
I.T.I.O., fee	1	1,256
I.T.I.O., Trosper	2	3,044
I.T.I.O., Watters	1	Off
Mid-Kansas, Fortson	5	3,334
Mid-Kansas, Browning	1	570
Mid-Kansas, Trosper	1	253
Prairie, Hiddleston	3	3,226
Hall & Briscoe, Childs	1	4,131
Shell, Petty	2	4,890
Sinclair, School land	1	991
Sinclair, Stamper	3	1,006
Sinclair, Kinter	2	1,325
Slick, Glidden	2	9,585
Wirt Franklin, Lowery	1	3,292
Total	40	64,454

Oil in McClain County

Homaokla Oil Co.'s No. 1 Newsom, SE cor. NE NE, Section 16-5-3, McClain County, which is now owned by the Sunray Oil Co., has extended the producing area southwest from the old Asher Field, in Pottawatomie County, by finding a showing of oil in the Viola lime at 3,582-87 feet. It swabbed 5 bbls. an hour and some estimate it to be a 200-bbl. producer. Casing will be underreamed before a final production test is made.

Greater Seminole Field

East Earlsboro Pool had 17 new wells last week with an increase of 2,100 bbls. daily. The pool is being defined by a number of wells showing water, mostly on the east and south sides. The following wells were showing water last week: Prairie Oil & Gas Co.'s No. 1 Wilson, SW cor. Section 8-9-6. Same company's No. 4 Calkins, SE cor. NW SW Section 17-9-6; No. 2 Wisener, NE cor. NW Section 18-9-6. Burke-Greis Oil Co.'s No. 3 Jones, NE cor. SW SW Section 17-9-6; No. 4 Jones, SE cor. SW SE Section 17-9-6; No. 1 Wentz, NW cor. NE SW Section 17-9-6; No. 2 Wentz, SW cor. NE SW Section 17-9-6. Magnolia Petroleum Co.'s No. 3 Pannos Anderson, NE cor. Section 18-9-6. Carter Oil Co.'s No. 2 Wrightsman, NE cor. Section 19-9-6. The largest well completed in the pool last week was the Prairie Oil & Gas Co.'s No. 1 Jefferson, NE cor. NW SE Section 19-9-6. It made 4,500 bbls. the first 24 hours from the Wilcox sand at 4,137-64 feet on air lift after a 20-quart shot. Sinclair Oil & Gas Co.'s No. 1 Nichols, NE cor. NW NE Section 19-9-6, made 2,980 bbls. from Wilcox sand. Continental Oil Co.'s No. 1 McGuire, in Section 24-9-5, had the Wilcox sand at 4,170-85 feet, and made 785 bbls. the first 24 hours, swabbing. It has been shut in for the proration period. The pool was given another setback when McCulloch Oil Co.'s No. 1 Campbell, in Section 20-9-6, found water in the Wilcox sand at 4,314-43 feet. Production in the pool gauged 43,500 bbls. on November 29.

East Little River Pool had three new Wilcox sand wells last week. Production in the pool shows only a slight increase. The largest well completed was the Amerada Petroleum Corp.'s No. 1 Chilcoat, SW cor. SE NW Section 4-7-7, the most easterly producer in the pool. It had Wilcox sand at 4,262-68 feet, and made 1,020 bbls. the first 24 hours before being shut in for proration. Continental Oil Co.'s No. 7 Harrison, found water in the Wilcox sand, but the west offset drilled by The Texas Company, its No. 3 Chilcoat, swabbed 500 bbls. from the Wilcox sand at 4,220-30 feet. Sinclair Oil & Gas Co.'s No. 8 Phillips, SW cor. SE SE Section 5-7-7 had the Wilcox sand at 4,222-49 feet, and made 430 bbls. of oil and 100 bbls. water in 18 hours. Mid-Continent Petroleum Corp.'s No. 10 Smith, NE cor. NW SE Section 5-7-7, has been drilled deeper from 4,221-36 feet, in Wilcox sand, and increased its production from 300 bbls. to 1,500 bbls. daily after a 40-quart shot. The initial production of this well was 3,400 bbls.

Little River Pool had one new well last week and production was increased 750 bbls. The increase was mostly due to companies cleaning out old wells. The new well was completed by the Carter Oil Co., its No. 2 Elech, NW cor. SW SE Section 23-7-6, which made 180 bbls. a day from the Cromwell sand at 3,109-66 feet.

Maud Pool is declining and shows a loss of 600 bbls. from the previous week. Two new wells were completed in the pool last week. Shell Petroleum Corp.'s No. 3 Jordan, SW cor. SE NW Section 9-8-5, had Misener sand at 4,161-83 feet, and the total depth is 4,188 feet in Hunton lime. It flowed 625 bbls. the first 24 hours before being shut in for proration. Same company's No. 4 Jordan had Misener sand at 4,002-31 feet, the total depth being 4,036 feet, in Hunton lime. It swabbed 330 bbls. in eight hours and 800 bbls. in 24 hours and is now shut in for the proration period.

St. Louis Pool production shows an increase the last week, and is the second week in succession this pool has increased its daily production. The increase is mostly due to wells finding production in the Simpson lime in Township 7-4. The daily average production for the pool was 53,020 bbls. from 440 wells.

Asher Pool has declined about 175 bbls. from the previous week's gauges. The

(Continued on Page 201)

WILDCAT OPERATIONS IN OKLAHOMA

(Descriptions are East and North unless marked otherwise)

NORTHERN OKLAHOMA

ALFALFA COUNTY

Company, farm and location— Remarks:

Smith Bros.' No. 1 Forbes, SE cor. NW NW Sec. 12-27-11w ..... Shut down 1,232 ft.

J. W. Bailey's No. 1 Acre, SW cor. NE Sec. 14-24-11w.. Drlg. 4,639 ft.

BECKHAM COUNTY

Kay and others' No. 1 Martin, C E half E half NW Sec. 32-8-24w ..... Shut down 2,056 ft.

Producers Exploration Co.'s No. 1 Seidell, SE cor. SW SW Sec. 17-9-22w ..... Shut down 2,402 ft.

Carson and others' No. 1 Danby, SW cor. SE NE Sec. 20-8-22w ..... Shut down 1,617 ft.

BLAINE COUNTY

Lowen and others' No. 1 Unknown, NW cor. SW NW Sec. 27-16-11w ..... Spudded and shut down.

Washoma Oil Co. and others' No. 1 Phillips, C NW SW Sec. 12-19-10w ..... Shut down 2,935 ft.

CADDO COUNTY

Abernathy & Brown's No. 1 Horton, SE cor. Sec. 8-6-13w. Shut down 535 ft.

W. J. Hartley's No. 1 Galbreath, SE cor. NW SE Sec. 29-5-12w ..... Shut down 3,394 ft.

CLEVELAND COUNTY

Harris et al's No. 1 Highbee, SE NW Sec. 20-6-1 ..... Rig.

Daniels & LeWright's No. 1 Vandever, C SW Sec. 15-7-1w ..... Shut down 3,130 ft.

Phillips Pet. and T. B. Slick's No. 1 Sudick, NE cor. NE Sec. 8-10-2w ..... Drlg. 7,485 ft.

COAL COUNTY

W. E. McGraw's No. 1 King, C SW NE Sec. 11-1-8e .... Shut down 1,285 ft.

COMANCHE COUNTY

G. W. Stogner's No. 1 Doebel, C SW SW Sec 3-3-9w ... Rig.

Green and others' No. 1 Wilson, C NE SW Sec. 14-1-12w.. Shut down 4,055 ft.

CREEK COUNTY

Carter Oil Co. et al's No. 1 Clinton, SW NW Sec. 12-15-9.. Drlg. 2,580 ft.

GARFIELD COUNTY

Continental and Barnsdall's No. 1 Brown, CNL SW Sec. 10-20-4w ..... Rig.

E. L. Love and others' No. 1 White, SE cor. NW Sec. 9-24-6w ..... Underreaming 5-in. csg. 5,566 ft.

GRADY COUNTY

J. V. Bailey's No. 1 Hubbard, C NE NW Sec. 1-10-6w... Spudded and shut down.

J. M. Henry and others' No. 1 Abraham, SE cor. NW Sec. 4-5-8w ..... Rig.

GRANT COUNTY

Gypsy Oil Co.'s No. 1 Belderbeck, C SE SE Sec. 27-28-7w. Cored 4,065-78 ft.

Bailey's No. 1 Stover, C SW SE Sec. 20-27-5w ..... Rig on ground.

Baucher et al's No. 1 Deadman, SW SE Sec. 12-28-4w.. Underreaming 6-in. csg. 3,982 ft.

Cowden and others' No. 2 Vollmer, CEL NE SW Sec. 22-25-4w ..... Shut down 5,640 ft.

Otstot's No. 1 Tabor, C NE NE SE Sec. 23-26-3w ..... Drlg. 1,580 ft.

GREER COUNTY

Helmerick & Payne's No. 1 Henck, NW cor. Sec. 23-6-24w. Drlg. 2,200 ft.

I. T. I. O. and others' No. 1 fee, C SW NE Sec. 17-6-24w ..... Straightreaming 1,902 ft.

S. M. Stauffer's No. 1 Castleman, SW NE Sec. 8-4-26w .. Shut down 625 ft.

HARPER COUNTY

Sinclair Oil & Gas Co.'s No. 1 Howell, C SW SW Sec. 14-26-24w ..... Fishing 6,161 ft.

(Continued on Page 162)

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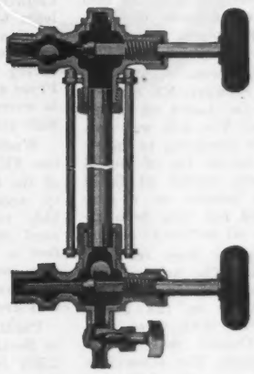

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Another Wildcat Showing in Sedgwick

Kansas Fields Were Otherwise Unusually Uneventful. Production Declines Slightly. Proration Extended

By W. A. Spinney
Staff Correspondent, Kansas Fields

Production in Kansas declined this week, the daily average for the State totaling 108,800 bbls. which is a 1,500-bbl. decline from the previous week's record. This decrease is mostly due to the cold weather and the curtailment of flush production in several pools.

Sedgwick County has another wildcat test showing oil southwest of Wichita. Don Moore's No. 1 Stewart, NE cor. SE NW, Section 18-28-1w, found oil in the lime at 3,365-94 feet. The hole was caving and owners were preparing to underream 6-inch casing to the top of the oil showing. Casing was landed at 3,275 feet. This well is located on a core drilled structure and has long been regarded as favorable oil territory.

Only 10 first reports were recorded in Kansas last week. The holiday and cold weather is blamed for the falling off of new operations in the State. Greenwood County led with three new operations. Chase County was second with two new locations. The other five reports were scattered in the following counties: Barber, Coffey, Cowley, Marion and Sumner Counties.

In the northeastern part of the State, north of Kansas City, Kans., on the Fairfax airport in Wyandotte County, the Fairfax company has completed 15 gas wells with an open flow said to be in excess of 23,000,000 feet. It also has several others drilling. The gas is found at approximately 360 feet. One of the tests has been drilled to the 585-foot horizon and found another gas sand. This deeper sand is not being developed and will be held in reserve until the shallow sand has been exhausted. The Fairfax airport is located on the west side of the Missouri River and is 1½ miles north of the junction of the Missouri and Kansas Rivers.

Gas now being produced is used at the airport, the surplus being sold to pipe lines now connected with the field. The company expects to develop the field until it has an open flow of 50,000,000 feet a day. The area has been geologized and the company is planning to drill a deep test to the Bartlesville sand to determine the formations. The indications are that oil or gas may be found in deeper horizons.

Proration Continued

Producers operating in the Valley Center Pool, in Sedgwick County, at a meeting held last week agreed to continue the proration program until January 15, 1930. The old proration agreement expires December 4. No changes in the potential figures were made. These new potentials are taken every 10 days. The same curtailment plans calling for 50 per cent proration will be in effect in this pool.

Continental Oil Co.'s No. 1 in Section 7-18-25w, Ness County, is averaging 135 bbls. daily, flowing. This wildcat is the most westerly producer in the State. The same company is blocking acreage southwest of its discovery well and also in Townships 20-26w, and 20-27w, Ness County.

Slick, Pryor and Lockhart have taken a block that centers in Section 3-18-10w, Rice County, which will be core drilled and a location may be made for a test well in the near future.

Empire Oil & Refining Co. is blocking acreage in Stafford, Reno, Pratt and Kingman Counties. These counties have been the most active from the standpoint of leasing in the State.

In Reno County, McBride, Inc., has made a location for No. 1 Community SW cor. NE SW Section 36-23-5w. Shell Petroleum Corp. and others have staked a location for a test in the C NW NW Section 17-25-4w.

Tatlock and others have made a location in SW cor. Section 25-19-8w, Rice County, for a test well. Vickers Petroleum Co.'s No. 1 Binger, NW cor. SE Section 21-20-10w, Rice County, will spud in a few days. It offsets the discovery well recently completed by Slick, Pryor and Lockhart, No. 1 Schurr, which is averaging around 120 bbls. daily of high gravity oil.

Washoma Oil Co.'s No. 1 in the NW cor. SE Section 35-31-2, in the south end of the Churchill Pool, in Sumner County, appears to be good for about 125 bbls. to 150 bbls. from the Stalnaker sand at 1,933-36 feet. Oil rose 1,500 feet in the hole in 12 hours. The well was running about the same on structure as the other producing wells in that area.

Phillips Petroleum Co.'s No. 1 Weigel, in Section 19-12-17w, Ellis County, has 2,500 feet of oil in the hole. The oil was found at 3,441-51 feet. This test is located 2½ miles south of the Shutts lease, which has been making around 400 bbls. daily until recently when it was shut in.

Empire Oil & Refining Co. has announced a new location in Chase County. It will be No. 1 Newman, SE cor. NE Section 24-20-9, about 10 miles southwest of Emporia. Development of Chase County has been slow during the past year. Most of the other wildcat tests have been dry.

Wilcox in Elk County

The new Wilcox sand producer near Severy, in Elk County, has been swabbed and in six hours it made 180 bbls. This well, owned by Clark Oil Co. and others, is No. 1 Sloan, in Section 9-29-9, Elk County. Oil is coming from the Wilcox sand at 2,640-43 feet. After standing overnight it was again swabbed and made 174 bbls. in eight hours. It is 6 miles from the nearest production.

Shell Petroleum Corp. has added another oil well to the Greenwich area. It is No. 2 Lygrisse, NE cor., Section 14-26-2, Sedgwick County, in the northeast extension. It swabbed 660 bbls. the first 24 hours, of which 30 bbls. was water, from chat at 2,868-70 feet. This well is a location south of the same company's No. 1 Endwein, which made 1,000 bbls. when completed a short time ago. A location east of the Shell Petroleum Corp.'s No. 2 Lygrisse, Gypsy Oil Co.'s No. 4 Hamant, NW cor., Section 15-26-2, found about 500 bbls. of water after swabbing seven hours. It will be drilled deeper to the Wilcox sand.

Gypsy Oil Co.'s No. 1 Gibson, in Section 27-29-4w, Grant County, Oklahoma, is being plugged. It is within 300 feet of the state line, near Caldwell, Kans., and is just over the line in Oklahoma. The test is too deep to be pumped at a profit as it was only making 5 bbls. daily. Oil was found in the Wilcox sand at 4,863-67 feet, discovery well of the pool. Same company's No. 1 Williams, in Section 16-35-3w, Sumner County, Kansas, was pumping 75 bbls. daily. The initial output of the discovery well was 1,600 bbls. daily.

Minnehoma Oil Co. and others' No. 3 Denton, NW cor. SW SW, Section 3-31-8, Elk County, made 70 bbls. from the lower pay at 1,983-2,002 feet. This well was drilled deeper from the old total depth of 1,350 feet. Mann and others' No. 1 Dory, SW cor., Section 6-31-9, Elk County, has been abandoned at 2,395 feet.

Sumner County

In the Wellington area, Shell Petroleum Corp.'s No. 1 Armstrong, NE cor., Section 12-33-1, Sumner County, had a showing of oil in the chat at 3,400-57 feet, and was drilling deeper at 3,485 feet. It is a wildcat located 10 miles southwest of Wellington, and is halfway between the Rainbow Bend Pool and the Miller and Padgett Pools. It will be deepened to the Wilcox sand. North of Wellington, Slick, Pryor & Lockhart's No. 1 Peasel, NW cor., Section 33-31-1w, Sumner County, found a showing of oil, which rose 2,000 feet in the hole from the chat at 3,675 feet. The 6-inch casing is being underreamed to test the oil showing. Blankenship Petroleum Corp.'s No. 1 Dial, NW cor. SW, Section 2-34-4w, Sumner County, was spudding. Blackwell Oil & Gas Co.'s No. 1 Clift, SE cor. NW, Section 26-33-3w, north of Caldwell, was getting ready to spud the first part of the week.

Western Kansas

Of western Kansas, approximately 10,000,000 acres is under lease. Oil companies operating in that part of the State are paying the land owners about $10,000,000 in rentals each year in the great undeveloped territory in the western and northwestern part of Kansas. In a great many cases farmers living on the land are receiving more money each year from the oil companies than the taxes assessed against their land. It looks as if the oil companies were paying taxes on about 10,000,000 acres of land in the western part of the State. In the great undeveloped area west of the meridian line, Stafford County is nearer being 100 per cent leased than any other county. Ninety per cent of its land is leased, and it does not have a barrel of production at this time, and only one wildcat test drilling, yet it appears to be the most attractive area to oil companies from a leasing standpoint. Ellis County ranks second with about 80 per cent of its land being leased, while McPherson and Sedgwick County are about tied for third with almost 80 per cent of each under lease for oil and gas purposes. The other western counties are leased from 5 to 50 per cent at this time. The leasing campaign which has been under way for the last year has quieted down partly due to the overproduction of crude oil in the Mid-Continent area.

An interesting wildcat test which has good chances of developing into a pool opener is drilling near the Kingman and Sedgwick County line. Some consider it to be running high on structure and it maye find production in the chat. The test is the White Eagle Oil & Refining Co.'s No. 1 Lorenz, in Section 25-27-5w, Kingman County, and it has reached a depth of 3,660 feet. Formations were reported to be running some 80 feet higher than those in the test drilled 3 miles east. Owners expect to encounter the chat at approximately 3,700 feet. This test was drilled on a core drilled block.

McCullough Oil Co. and others' No. 1 Cornillson, SW cor. Section 7-21-4w, McPherson County, is finding the formations higher than those other tests drilled in the vicinity and many expect this wildcat to develop into a producer. It was drilling at 3,075 feet on the report of November 29. It is located 8 miles west of the new Voshell Pool in the same county.

The new well in the Voshell Pool which is being drilled by the Mid-Kansas Oil & Gas Co. is still underreaming with the oil hole standing full of oil. It is the farthest test to the west in the pool at this time, and it found the Wilcox sand higher than any of the other wells, some 74 feet higher than the Empire Oil & Refining Co.'s No. 1 Voshell, a half mile southeast. The Wilcox sand was found at 3,190-94 feet, and many expect it to be the largest producer in the field.

Butler County

Jones and others' rig is up for No. 1

(Continued on Page 202)

WILDCAT OPERATIONS IN KANSAS

(Descriptions are East unless otherwise marked)

BARBER COUNTY

Company, farm and location—	Remarks:
Skelly Oil Co.'s No. 1 Temple Ranch, Sec. 13-34-15w	Shut down 4,410 ft.
Robertson et al's No. 1 Powell, SE cor. SE Sec. 11-32-10w	Shut down 3,260 ft.

BARTON COUNTY

Prairie's No. 1 Davidson, NW SE Sec. 4-16-11w	Rig on ground.
Allison & Fitzwilliams' No. 1 Brodie, NE cor. Sec. 19-16-12w	Drlg. 2,730 ft.
Slick et al's No. 1 Sweeney, SW NE Sec. 23-17-11w	Drlg. 1,285 ft.
Everett & Wiley's No. 1 Ward, NW cor. SW Sec. 12-20-13w	Shut down 3,948 ft.

BUTLER COUNTY

Lario O. & G. Co.'s No. 1 Hill, SW SE Sec. 1-27-4	Drlg. 1,410 ft.
Lario O. & G. Co.'s No. 1 Miller, NE SE NE Sec. 36-26-3	Drlg. 1,795 ft.
Martin et al's No. 1 Flanigan, C SW SE SW Sec. 29-27-3	Drlg. 600 ft.
Sinclair Oil & Gas' No. 1 Johnson, NE cor. Sec. 16-26-3	Drlg. 3,217 ft.
Stroub & Dutton's No. 1 Kirby, SE SW Sec. 12-28-3	Drlg. 1,400 ft.
Valley Osage's No. 1 Sirs, SE cor. Sec. 34-23-3	Shut down 2,600 ft.

CHASE COUNTY

E. W. Marland, Inc.'s No. 1 Altemus, SE NE Sec. 33-18-6	Drlg. 1,050 ft.

CLAY COUNTY

Chrisler et al's No. 1 Tivier, SW cor. Sec. 19-8-3	Rig.
Derby Oil Co.'s No. 1 Meimueller, C NW SW Sec. 9-10-3e	Drlg. 2,885 ft.
Skow Bros.' No. 1 Strud, SW SE Sec. 16-9-4	Shut down 2,510 ft.

COWLEY COUNTY

Prairie's No. 1 Leighty No. 1 Ball, SW SE Sec. 4-30-5	Drlg. 1,320 ft.
A. M. Landon's No. 1 Wheeler, C SW NW SE Sec. 24-30-4	Drlg. 2,450 ft.
Milton & Mead's No. 1 Tatum, SE cor. SW Sec. 11-31-6	Drlg. 1,380 ft.
Roth & Farrout's No. 1 Thompson, NE SE Sec. 31-31-8	Drlg. 1,575 ft.
Shawver et al's No. 1 Oldham, NW SE Sec. 23-32-3	Shut down 2,440 ft.

DICKINSON COUNTY

Cress' No. 1 Sanden, NE cor. Sec. 12-15-2	Rig on ground.
Prairie's No. 1 Lachard, C NW SW NE Sec. 12-16-2	Rig.
Hiatt & Durham's No. 1 Wendt, NW cor. Sec. 17-16-2	Spudding.
Kruger et al's No. 1 Diche, C NW NE NE Sec. 17-13-4	Drlg. 2,090 ft.

DOUGLAS COUNTY

Jenkins & Scott's No. 1 Haden, SE NW Sec. 10-13-17	Drlg. 550 ft.

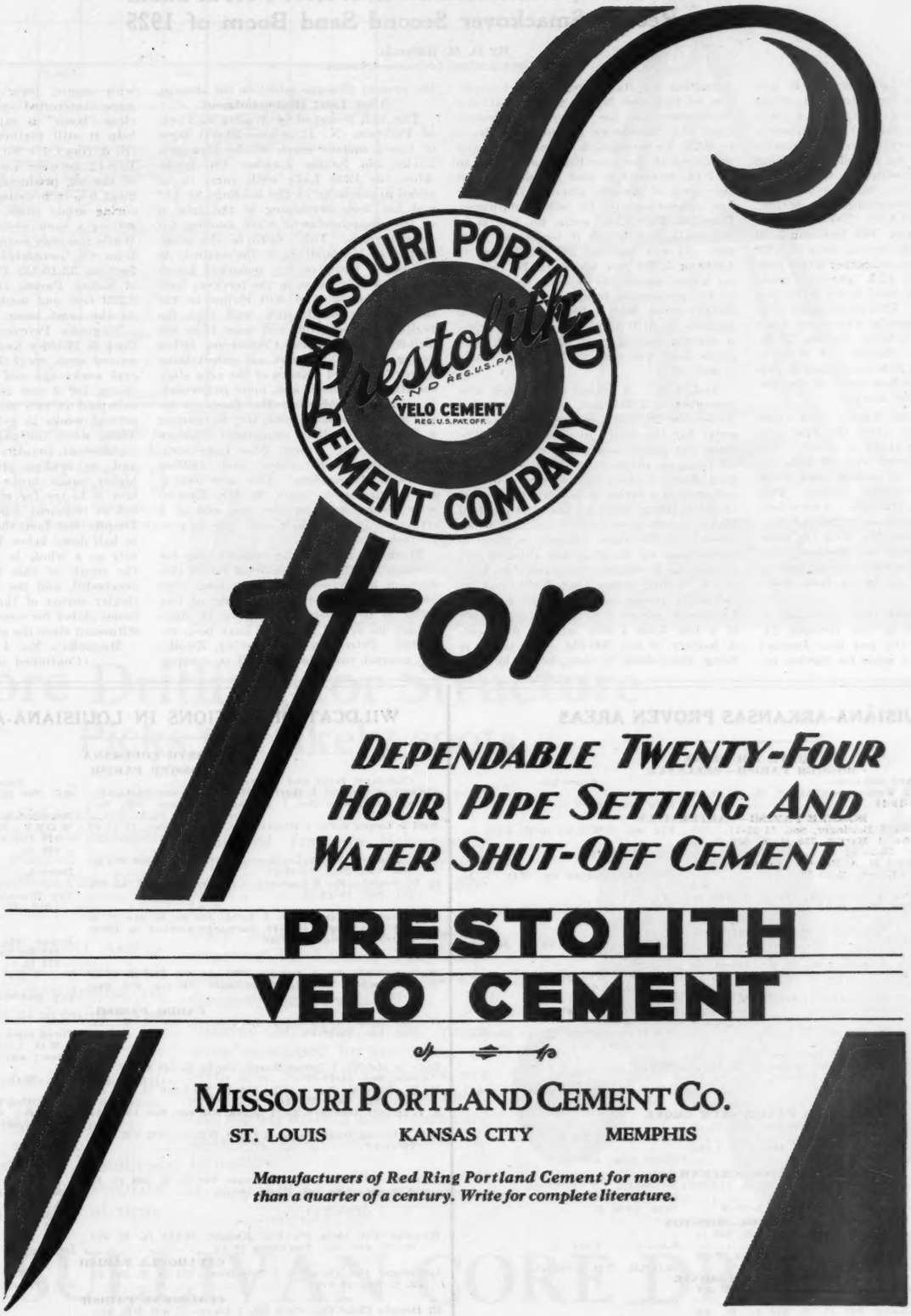
EDWARDS COUNTY

Skelly's No. 1 Johnson, NE SW Sec. 21-26-17w	Drlg. 800 ft.
Barnsdall Oil's No. 1 McCarty, NW NE Sec. 31-25-17w	Rig.
Dixie & Amerada's No. 1 McCarty, SW cor. Sec. 22-25-17w	Drlg. 585 ft.

ELK COUNTY

Empire and Arkansas Fuel's No. 1 Record, C SW SE SW Sec. 32-30-10	Drlg. 250 ft.

(Continued on Page 219)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Zwolle Area Well Estimated 5,000 Bbls.

Intended for Deep Test but Came In at 2,415 Feet in Chalk Rock. Recalls Smackover Second Sand Boom of 1925

By D. H. Bancroft
Staff Correspondent, Louisiana-Arkansas

SHREVEPORT, La., Dec. 3.—It was a real Thanksgiving for Shreveport, which has suffered a long series of disappointments, and an equally long period of declining production, when R. L. Gay, trustee's No. 1-A Bowman-Hicks, Section 34-8-12, 200 feet west and 900 feet south of the center, came in with an estimated 5,000 bbls. of 41.5 gravity crude from 8 feet of sand, total depth 2,413 feet in the chalk rock. Disappointment over salt water in Magnolia Petroleum Co.'s No. 1 McCook & Hibbler, Section 22-21-10, Cotton Valley district of Webster Parish, the deepest hole yet drilled in this area, disappeared when news of the Sabine wildcat reached town.

Coincidentally, the Zwolle well came in a year to a day after the first producer in nearly 10 years of effort. The original well completed with 50 bbls. initial from 12 feet of broken sand, total depth 2,130 feet through tubing. This well is now flowing 180 bbls. Two subsequent wells have increased their production on like scale, and No. 5 on the same lease (Bowman-Hicks in Section 14-7-14) is waiting for standard rig, looking like a 50-bbl. well or better from 2,586 feet.

There was a rather full discussion of the Zwolle district in the October 24, 1929 issue of The Oil and Gas Journal to which reference is made for further information on its geology, etc. Completion of this well is the most sensational development in the Shreveport division since the Smackover Second Sand boom in 1925. Its location is 12 miles east and northeast of the four Blue Lake wells in 14-7-14, referred to and 3 miles east of the town of Zwolle, whereas the others are approximately 10 miles southwest. Like the Blue Lake wells, the pay is in the chalk rock which it topped at 2,330 feet. It was intended for a deep test to 4,500 or 5,000 feet which H. D. Easton, on whose geological reports the owners of the properties, totaling approximately 30,000 acres, have relied, has long been anxious to drill in that area; but when it started coming in it did so with such gusto there was nothing left but to make a well of it.

And it is! A string of 8¼-inch was cemented at 2,397 feet, plug was drilled November 26 and the pressure was too great for the drill to come out. The stem was pulled and gate connected with oil going up through the derrick and running down a steep ravine where it was collected in a series of ponds with a crew of 50 building dams to catch production which accumulated faster than they could thrown up the dikes. Result is there is much loose oil painting the thick woods around the location. Standard Pipe Line Co. is rushing a line from Noble and incidentally trying to beat any previous Louisiana record for rapid construction of a line from a new wildcat producer. A battery of ten 500-bbl. steel tanks is being ramrodded to completion but for the present pits are relied on for storage.

After Long Disappointment

The well is owned by Walter E. Cook, of Paterson, N. J., whose 30,000 acres of leases include much of the Bowman-Hicks and Sabine Lumber Co. lands. After the Blue Lake wells came in he added appreciably to the holdings he had and has been developing in the face of of one disappointment after another for several years. This faith in the possibilities of his holdings is due entirely to the belief, based on his technical knowledge and experience, in the territory held by Mr. Easton who still claims in the face of this chalk rock well that the really big production will come from the Trinity of the Lower Cretaceous. Other geologists of Shreveport are entertaining a greatly altered opinion of the area since the Blue Lake wells and, more particularly, this one. Meeting Mr. Easton's desire and recommendations, Gay is running a three-way drilling campaign; developing the already proven Blue Lake area, prospecting deeper zones and drilling semiwildcat locations. This new well is one of the latter, made by Mr. Easton, who claims it is on the east end of a structure 12 miles long and wide in proportion.

Meantime there is the briskest play for acreage, royalties and mineral rights this division has experienced in a long time and there is already talk of four or five wells to be under way within 10 days though no actual locations have been reported. Prices are skyrocketing. Zwolle, the nearest town to the well is overrun with scouts, lease men, geologists and mere "interested spectators" and a first class "boom" is rapidly developing. To help it still further and faster, Sabine Oil & Gas Co.'s No. 1 Anderson, Section 19-8-12, between 4 and 5 miles northwest of the big producer, is arranging to cement 6⅝-inch casing at 2,200 feet after coring sandy chalk from 2,190 feet and getting a show of oil from 2,200-06 feet. While this was going on, Magnolia Petroleum Co. completed No. 4 E. E. Hall, Section 33-10-12, Pleasant Hill district of Sabine Parish, flowing 50 bbls. from 3,239 feet and made location for No. 5 on the same lease.

Magnolia Petroleum Co.'s No. 1 McCook & Hibbler had cored 9 feet of saturated sand, total depth 6,965 feet, several weeks ago and in running 5 3/16-inch casing for a test found previous strings collapsed in two places and was delayed several weeks in getting past the pinch. Then, when the pay string was set, an insufficient quantity of cement was used and, on drilling plug, salt water from higher sands broke through. The plan now is to try for returns and if successful to recement and make another test. Despite the fact that it was impossible to bail down below 1,800 feet, the fraternity as a whole is not pessimistic as to the result of this test. Between it, if successful, and the Zwolle well this particular corner of the Shreveport division seems slated for more activity than it has witnessed since the passage of Smackover.

Magnolia's No. 1 N. T. Knight, Sec-

(Continued on Page 209)

LOUISIANA-ARKANSAS PROVEN AREAS

NORTH LOUISIANA

BOSSIER PARISH—BELLEVUE

Company, farm and location—	Remarks—
H. L. Morgan's No. 2 Wetherbee, 3,811 ft. E, 200 ft. S, NW cor., Sec. 28-19-11	Drlg. lime 2,083 ft.

BOSSIER PARISH—CARTERVILLE

Del.-Lal. Dev. Co.'s No. 5 Bollinger, Sec. 31-23-11	Rig up; O.W.D.D; drlg. 3,100 ft.
Goodman-Johnson's No. 1 Martin, 330 ft. S, 330 ft. E, NW cor. SE, Sec. 26-23-12	Drlg. 1,827 ft.
Magnolia Pet. Co.'s No. 1 M. A. Rogers, 660 ft. S, 660 ft. W, NE cor. NE SE Sec. 21-23-12	O.W.D.D., rigging up; T.D. 3,127 ft.
Magnolia Pet. Co.'s No. 1 Robertson, 412 ft. S. 660 ft. E, NW cor. SW NE, Sec. 26-23-12	O.W.D.D; rigging up to deepen; 3,058 ft.
Muslow Oil Co.'s No. 1 Barnett, 1,320 ft. W, 660 ft. N, SE cor., Sec. 25-23-12	O.W.D.D; rigging up to deepen; T.D. 3,076 f..
Muslow Oil Co.'s No. 1 Kilgore, 2,080 ft. N, 1,980 ft. E. SW cor., Sec. 31-23-11	O.W.D.D; arranging to deepen; T.D. 3,078 ft.
Muslow Oil Co.'s No. 1 Mark Myer, 1,980 ft. N, 330 ft W, SE cor., Sec. 36-23-12	O.W.D.D; arranging to deepen; T.D. 3,088 ft.
Muslow Oil Co.'s No. 1 Peyton, Sec. 30-23-11	O.W.D D; rigging up to deepen; T.D. 3,042 ft.
Northwest La. Gas Co.'s No. 5 Bolinger, 252 ft. E. 200 ft. S, NW cor. Lot 7, Sec. 31, in Sec. 38-23-11	Rigging up.
R. G. Smitherman, trustee's No. 1 Kilgore, 1,310 ft. E, 675 ft. S, NW cor., Sec. 31-23-11	O.W.D.D; rigging up to deepen; T.D. 3,062 ft.

BOSSIER PARISH—ELM GROVE

La. Gas & Fuels Co.'s No. 1 T. A. Lawrence, 3,300 ft. N and W, SE cor., Sec. 12-17-12	Cmtd. 6-in. 1,710 ft.
La. Gas & Fuel Co.'s No. 1 Murff et al, 660 f.. S, 1,980 ft. W, NE cor., Sec. 24-17-12	Cmtd. 9-in. 876 ft.

CADDO PARISH—GREENWOOD

Calatex O. & G. Co.'s No. 1-A Agurs, 819 ft. S. 157 ft. E, NW cor. SW, Sec. 7-16-16	Drlg. 2,755 ft.
Eastern Carbon Co.'s No. 1 Z. Abney, Sec. 8-17-16	Drlg. 2,600 ft.

CADDO PARISH—HOSSTON

Bayou State Oil Corp.'s No. 28 Jolly, 500 ft. N, 150 ft. W, SE cor. NE, Sec. 22-22-15	S.D; W.O; 1,004 ft.
Bayou State Oil Corp.'s No. 18 Levee Board, 450 ft. N, 150 ft. E, SW cor. NW, Sec. 23-22-15	W.O.S.R; T.D. 1,003 ft.

CADDO PARISH—DIXIE

Fitzsimmons Drlg. Co.'s No. 1 Sentell, C W½ NW SW SW, Sec. 10-19-14	Location.
Sam Gold's No. 3 Hunter, 660 ft. N, 660 f.. W, SE cor. SW NE, Sec. 17-19-14	200 ft. oil and S.W. in hole 2,457 f ; W.O.S.R; topped broken sand 2,415 ft.
Ohio Oil Co.'s No. 4 Hunter, 330 ft. N and W, SE cor. NW NE, Sec. 17-19-14	Derrick.
Standard Oil Co.'s No. 4 School, Sec. 16-19-14	Standing 1,300 ft. in oil; W.O.S. R; T.D. 2,439 ft.
The Texas Company's No. 2 Sentell, 990 ft. N, 272 ft. E., SW cor. Sec. 9-19-13	Location.
The Texas Co.'s No. 3 Hunter, 990 ft. W, 330 ft. N, SE cor., Sec. 8-19-14	S.D. 2,448 ft.

(Continued on Page 203)

WILDCAT OPERATIONS IN LOUISIANA-ARKANSAS

NORTH LOUISIANA

BOSSIER PARISH

Company, farm and location—	Remarks—
Corbett et als' No. 1 Murff, SE cor. NE, Sec. 18-17-11	S.D. 990 ft.
Simon Goldman's No. 1 McFarlin, SE cor. SW, Sec. 7-19-13	Began drlg. Nov. 26; S.D. 223 ft.
Neil & Lanier's No. 1 Biedenharn, SE cor., Sec. 23-21-14	W.O.S.R.; 980 ft. oil in hole; T.D. 998 ft.; arranging to re-test at 998 ft.
S. P. Lanier's No. 1 Le Rosen, 300 ft. S., 1,600 ft. W, NE cor. Sec. 26-21-14	Derrick.
G. D. Nesbit's No. 1 Leonard, 1,900 ft. N, 957 ft. E, SW cor. Sec. 20-19-13	Top Blossom 2,054 ft; bailed dry 2,057 -78 ft.
Old River Oil Corp.'s No. 1 Byrd, 300 ft. E, 300 ft. S, NW cor., Sec. 14-19-14, formerly carried in Dixie district of Caddo Parish	Began drlg. Nov. 7; cmtd. 10-in. 102 ft; fishing for slip; T.D. 2,375 ft.
Walker et als' No. 1 Antrim, NW cor. SE, Sec. 28-22-13	Tested dry; W.O. 3,184 ft.
Woodmansee et als' No. 1 Bollinger, SE cor. NE, Sec. 9-22-11	Dry and abd. 3,532 ft.

CADDO PARISH

Haynes Bros.' No. 2 Oden, 1,650 f.. S., 330 ft. W, NE cor. Sec. 20-19-14	Cored sand showing S.W. 2,471 ft.; W.O. 2,505 ft.; may make deep test; waiting order 2,505 ft.
Lide ta als' No. 1 Levee Board, 200 ft. S, 200 ft. W, NE cor. Sec. 24-19-15	S.D.; W.O. 2,475 ft.
R. W. Norton's No. 1 Hill, 630 ft. N, 1,260 ft. W, SE cor. NE, Sec. 22-22-16	Drlg. lime 4,100 ft.
S. T. Oynett, trustee's No. 1 Dixon, SW cor. Sec. 10-19-14	W.O.S.R.; making small heads; T.D. 2,444 ft.
I. N. Pharisa, trustee's No. 1 Oden, NE cor. SE NE, Sec. 16-19-14	S.D. 2,322 ft.; topped sand at 2,396 ft.; set 6⅝-in.; T.D. 2,409 ft.
Planters Oil Co.'s No. 1 Pittman, 200 ft. S, 200 ft. E, NW cor. NE, Sec. 23-19-14	Deep sand test 6 ft. broken sand 2,502 ft.; dry show oil; casing 2,530 ft.; S.D. waiting orders 2,585 ft.
Woodley Pet. Co.'s No. 5-A Knight, 26,185 ft. E, 660 ft. N, SW cor. Township 16-12	Location.

CATAHOULA PARISH

Lochnager Pet. Co.'s No. 1 Taliaferro, 572 ft. E, 396 ft. S, C, Sec. 26-9-6	S.D. 900 ft.

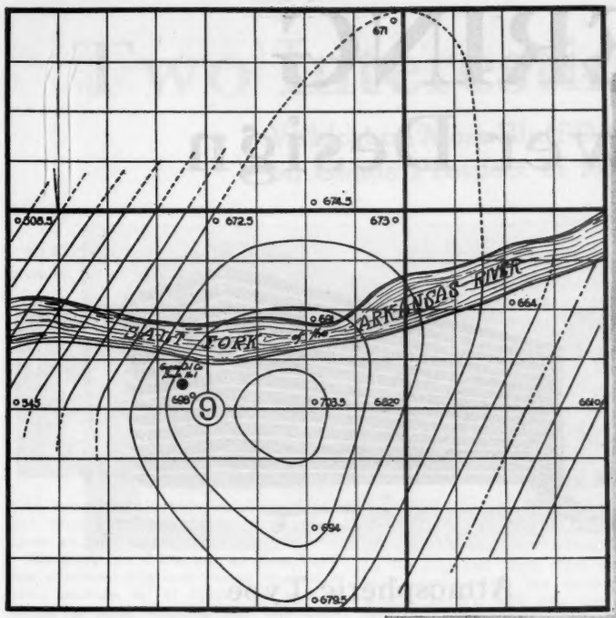
CLAIBORNE PARISH

El Dorado Chief Oil Co.'s No. 1 Dance, C SW NE, Sec. 27-20-7	S.D. 2,240 ft.
Leue Oil Co.'s No. 1 Taylor, Sec. 16-22-6	Derrick.
Triangle Drlg Co.'s No. 1 Kilpatrick, 660 f.. S, 660 ft. E, NW cor. SW NE Sec. 7-19-5	Drlg. rock 3,250 ft.

DE SOTO PARISH

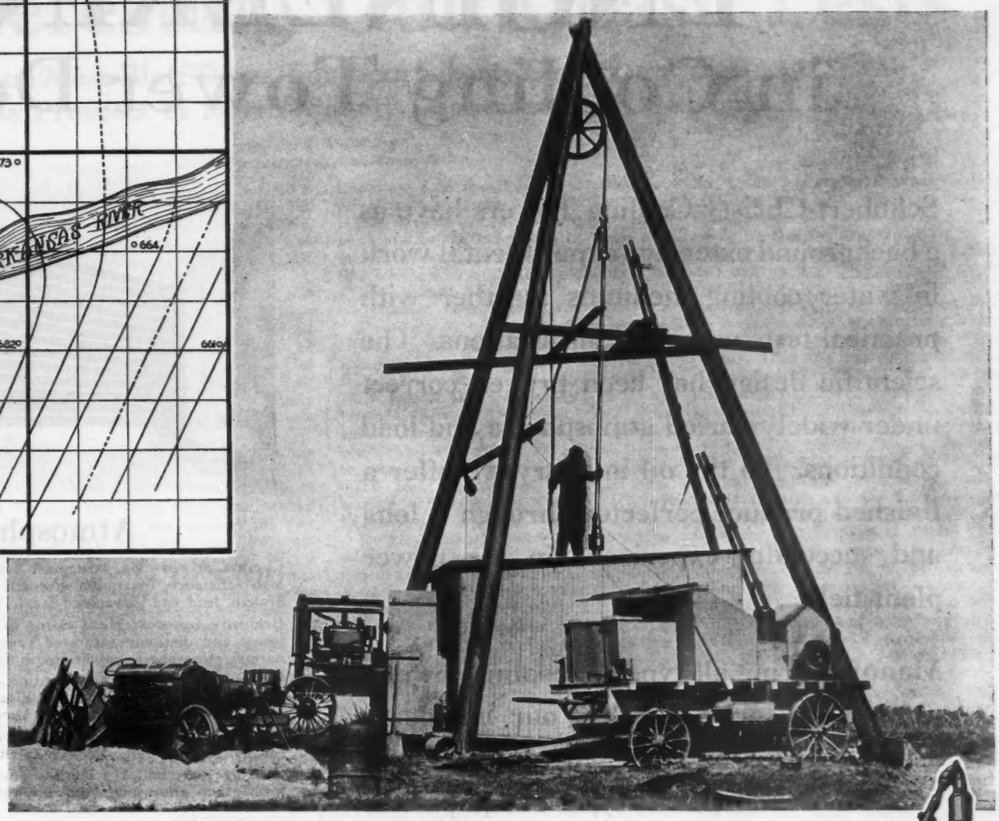
Benson Oil Co.'s No. 1 Harris, Sec. 6-10-13	Drlg. 1,800 ft.
Benson Oil Co.'s No. 1 Hill, 1,845 ft. S, 1,200 ft. W, NE cor. Sec. 4-10-13	Cmtd. 10-in. 265 ft.; drlg 700 ft.
P. J. Becker, trustee's No. 1 Tull, SW cor. NE NE, Sec. 23-12-15	Fishing 7 joints drill stem; T.D. 2,475 ft.

(Continued on Page 204)



A core drill map of the Chambers Dome, Section 9, Township 25, Range 2, West, showing location of core drill holes, and elevations of key bed, from which the map was drawn, and the high point of structure determined.

A Sullivan Core Drilling outfit making one of a series of structure tests in Harper County, Oklahoma



Core Drilling for Structure
Picks the likely spots

Eight years ago an oil company leased a rich tract of land, without drilling a test well. How geologists had found and mapped favorable structure with Sullivan Core Drills, was kept secret.

But the secret leaked out! And today, Sullivan Core Drills built especially for structure drilling, are reducing the cost of defining favorable structures.

Surface outcroppings may be insufficient. Or there may be a manifest nonconformity of structure.

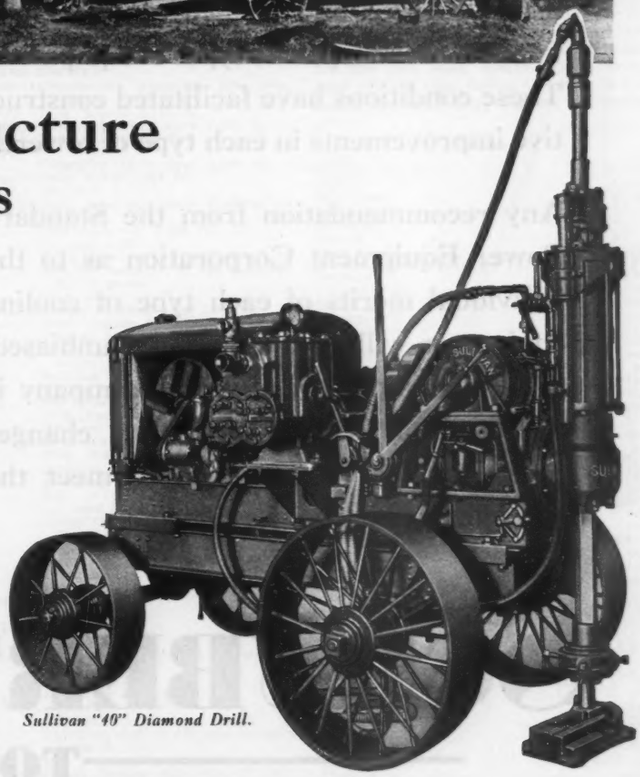
But the geologist, with a Sullivan Core Drill, can quickly determine the presence or absence of structure—and establish favorable well locations.

Near the Tonkawa high gravity field, a new area was core drilled, and a test well struck oil at 2066 feet.

Sixty Sullivan Drills are testing structure in Kansas. They have helped secure several producers in the new Wichita area.

Sullivan Structure Drills, which were developed by geologists, oil men, and Sullivan Engineers, are described in a new pictorial booklet. Actual drilling cost figures are included, with other valuable information.

A copy will be sent you gladly on request.



Sullivan "40" Diamond Drill.

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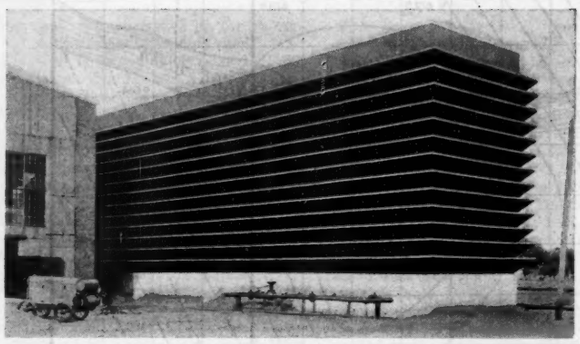
Schubert-Christy Cooling Towers have as a background extensive experimental work in water cooling mediums together with practical tests on actual installations. The scientific design has been proven correct under widely varied atmospheric and load conditions. To the oil industry we offer a finished product perfected through a long and successful experience in the power plant field.

Manufacturing all types of cooling towers, as well as spray nozzles, our engineers have observed and studied cooling effect for each of the separate types of equipment. These conditions have facilitated constructive improvements in each type of tower.

Any recommendation from the Standard Power Equipment Corporation as to the individual merits of each type of cooling equipment will be analytic and unbiased. Where conditions justify, this company is prepared to make additions or changes from standard construction to meet the specialized needs of the customer.



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Cypress or redwood, structural design and proportions such as to give high efficiency, maximum strength and long life. Metal parts: copper, bronze, lead and galvanized steel. Portable design for gasoline plants.

Exclusive features: Head casing to induce natural vertical draft through tower and dissipate saturated vapors to upper air currents. Maintains normal atmospheric conditions in vicinity of water distribution.

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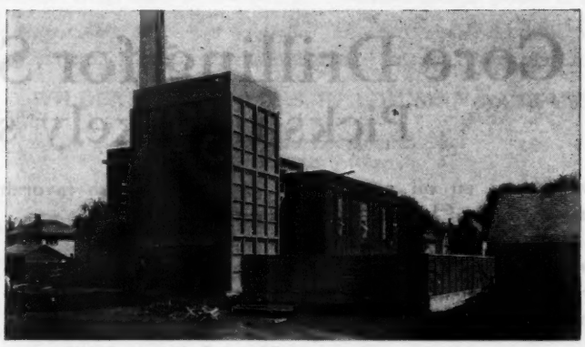
Vertical louvre boards to reduce warping, facilitate draining and prevent rotting. Louvre rail effective in checking drift loss.

Decking material of scientific design to redistribute water most uniformly and allow maximum air velocity through tower.



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Two Interesting Gulf Coast Tests

Wildcat on Moss Bluff Dome, Southern Liberty County, and Test on Genoa Prospect in Harris County, Southeast of Houston

By Neil Williams
Staff Correspondent, Gulf Coast Fields

HOUSTON, Tex., Dec. 2.—What promise to be two interesting tests are scheduled in Humble Oil & Refining Co.'s No. 6 Sterling, a wildcat on the Moss Bluff Dome of southern Liberty County, and in the same company's No. 2 Woodburn on the Genoa prospect in Harris County, just southeast of Houston. In neither of these new wildcatting areas has production been found but each is considered by most operators as most likely territory.

Humble's No. 6 Sterling at Moss Bluff has cemented 6⅝-inch casing to test a sand showing oil at 5,656 feet and at Genoa a sand showing gas has been encountered at a total depth of 3,425 feet and 13⅜-inch casing has been cemented at 3,405 feet. Over the week end both tests were waiting cement to set.

The Moss Bluff test is on the east side of the dome, on which nearly a dozen and a half tests have been drilled, which, although not finding production, have proved the dome to be one of the largest salt masses known on the Gulf Coast. Humble has drilled this series of six tests across the dome and until now has failed to get off the dome. The Woodburn test is the second to be drilled at Genoa, which so far has not been determined as a dome but which has been checked geophysically as a likely prospect, being one of this year's discoveries.

Brazoria Deep Test

Shell Petroleum Corp.'s No. 1 Blakely-Winston, first test on the Danbury prospect in Brazoria County and which indicated the existence of another new field when it swabbed a small amount of oil from a shallow sand at 1,572-77 feet, is passing this sand and drilling deeper. The well probably could have been completed as a small pumper but as it was rigged up for a deep test it will go on down and if a failure at lower levels it can come back to the shallow sand.

Considering completions, the Gulf Coast has just experienced one of its dullest weeks in several months. There were comparatively few new wells and all were small and except for one, Harvey Smith's No. 2 Ward at Humble, were of little importance from a new production standpoint. The latter is a semi-wildcat on the northwest side of the dome. It is approximately a half mile to the northeast of a producer drilled by John Deering several years ago, which has been the only production in that particular area. The Texas Company has obtained some oil farther around the dome on the north. The Ward well came in Friday flowing an estimated 700 to 800 bbls. from sand and shale at 4,356 feet.

At Hull, Humble Oil & Refining Co. got a fair well in No. 12 Hooks-Spell which came in estimated good for slightly better than 700 bbls. from sandy shale at 3,949 feet. South Texas Petroleum Co.'s No. 5 Blakely at Blue Ridge on the east side flowed initially at the rate of 613 bbls. of pipe line oil daily but later showed up 35 per cent basic sediment and water. Production is at 3,524 feet.

Old Hackberry Dome

J. G. Sutton's No. 1 Duhon, on the south side of old Hackberry Dome of Cameron Parish, came in estimated at 500 bbls. daily from sand at 3,198 feet. Three small wells were added at Raccoon Bend, including Humble Oil & Refining Co. and Valley Oil Corp.'s No. 10-B Deutrich, 400 bbls., 3,350 feet; No. 4-A Bracey, 250 bbls., 3,546 feet, and No. 6-A Walton, which late in the week was swabbing a small amount of oil at 3,364 feet.

Morgan Oil Corp.'s No. 1 Strauch was Refugio's chief completion but it was good for only 200 bbls. of pipe line oil at 3,683 feet. Saxet Oil Co.'s No. 11 Clint Heard flowed a small amount of fluid at 3,680 feet, and Houston Gulf Gas Co.'s No. 6 Shelly and The Texas Company's No. 1 Clint Heard were gassers.

Rexal Oil Co.'s No. 1 Smith was the only new well at Barbers Hill but at the close of the week several deep tests on the east and south sides were testing and several others has reached the pay level. Rexal's well was good for only 80 bbls. Paggi and associates' No. 5 Queen City, Saratoga, and M. E. Peveto Oil Co.'s No. 1 Cannon, both small pumpers, were the only producing completions.

Empire Gas & Fuel Co.'s No. 1 Jackson marked another failure on the so far unproductive San Felipe (Brookshire) Dome which straddles the Brazos River, the boundary line for Austin and Waller Counties. This tested black sulphur water at a total depth of 3,143 feet. This is the second test drilled by this company and is the fourth on the dome not including one started by the Dixie Oil Co. which was quit after drilling only a few hundred feet.

Humble Deep Tests Abandoned

Two deep tests on the south side of Humble were abandoned: Humble Oil & Refining Co.'s No. 1 Glass and No. 1 Oates. The former at a total depth of 7,019 feet is the deepest test drilled at Humble. Another deep test, Gulf Production Co.'s No. 19 Moore, the deepest test drilled at Orchard, Fort Bend County, was abandoned at a total depth of 6,756 feet in heaving shale. It sidetracked and drilled to a sand at 5,757 feet where it was dry.

Hockley's 20 odd years of wildcatting without finding commercial production added another failure with Humble Oil & Refining Co.'s No. 6 Warren, abandoned at 4,797 feet. Humble, jointly with Continental Oil Co. and the Staiti interests, is keeping one rig operating steadily at this dome and now is moving No. 6 rig to the location for No. 7.

Gulf Refining Co. has abandoned its No. 11-Z State on the Loreauville Dome. This test went into sand and was quit at approximately 1,400 feet.

Orange County Test

Late in the week, The Texas Company still was waiting the completion of storage facilities before testing No. 1 Polk in Orange County, the third test drilled on the new dome prospect northeast of Port Neches in southwestern Orange County. That this test will prove as good a producer as either of the two wells previously completed is the belief of the operators. Gulf Production Co.'s wildcat, No. 1 Starks, in this area, so far has proved disappointing having drilled to below 5,000 feet with no showing. The Texas Company's production was obtained from around the 3,100-foot level.

Of some interest is Shell Petroleum Corp.'s No. 3 Wilbert at White Castle, Iberville Parish, Louisiana. This well, the discovery producer of the dome, completed over a month ago flowing only about 50 bbls. net oil with considerable salt water, has been increasing steadily in flow until now it is making better than 260 bbls. daily net oil. This record throws White Castle in a little better light as a producer as the well at first was not considered of particular commercial value.

The fact that very little large flush production has been added the past 10 days accounts for the decline in the daily average production of coastal fields for the past week. Coastal fields averaged 182,975 bbls. during the week, a decrease of 4,245 bbls. Figures by fields are:

TEXAS	
Allen	11
Barbers Hill	21,400
Batson	1,297
Big Creek	3,796
Blue Ridge	2,486
Brenham	150
Boling	1,305
Clay Creek	1,800
Damon Mound	495
DeWalt	13,570
Fannet.e	1,516
Goose Creek	5,459
Hankamer	600
High Island	1,415
Hull	10,047
Humble	14,848
Jasper County	35
Lost Lake	348
Markham	366
Nash	525
North Dayton	555
Orange	3,250
Orchard	93
Pierce Junction	11,271
Port Neches	992
Raccoon Bend	9,012
Refugio	16,180
Shecks	303
Saratoga	986
Sour Lake	2,545
So. Liberty-So. Dayton	5,604
Spindletop	21,032
West Columbia	6,465
Total Texas Coast	159,757
Week ending November 23	163,448
Decrease	3,691

SOUTH LOUISIANA	
Anse La Butte	45
Bayou Blue	214
Bayou Bouillon	102
Black Bayou	150
Dog Lake	6
Edgerly	635
Jennings	1,483
Hackberry	4,249
Lake Barre	383
Lake Pelto	281
Lockport	3,257
New Iberia	20
Port Barre	960
Starks	416
Sulphur	6,100
Swee. Lake	17
Vinton	4,425
Welsh	213
White Castle	260
Total Lousana Coast	23,218
Week endng November 23	23,772
Decrease	554
Total Gulf Coast	182,976
Week ending November 23	187,220
Decrease	4,245

GULF COAST FIELDS AND WILDCATS

Week Ended November 30

BARBERS HILL—CHAMBERS COUNTY

Mills Bennett Production Co.'s No. 1 Collier (southeast)	Completed; pumping 100 bbls. daily 5,387 ft.
Mills Bennett Production Co.'s No. 2 Collier (southwest)	Drlg. gumbo 2,175 ft.
Mills Bennett Production Co.'s No. 2 Barber, north side	Drlg. shale and lime 4,176 ft.
Mills Bennett Production Co.'s No. 4 Smith, east side	Drlg. shale 5,165 ft.
Mills Bennett Production Co.'s No. 3 Hammon-Armstrong (southeast)	Cemented 18-in. csg. 5,105 ft.
Mills Bennett Production Co.'s No. 1 Wilburn (southeast)	Drlg. shale 4,965 ft.
Mills Pennett Production Co.'s No. 2 Means (east)	Location.
Gulf Prod. Co.'s No. 1 Wilburn	Drlg. sand and shale showing oil 5,155 ft.
Humphreys Corp.'s No. 8-A Kirby, north flank	Cemented csg. 5,489 ft.
Humphreys Corp.'s No. 2-C Kirby	Oil sand 5,361 ft.
Humphreys Corp.'s No. 6-B Kirby (workover)	Pumped salt water 4,120 ft; S. D.
Humphreys Corp.'s No. 1 Higgins	Swabbed some oil in cap rock 841 ft.; to pump.
Humphreys Corp.'s No. 1 Scott	Drlg. salt 2,170 ft.
Humphreys Corp.'s No. 1 McLean, east side	Cemented 10-in. csg. 1,741 ft.
Republic Production Co.'s No. 3 Kirby (southeast)	Drlg. gumbo 4,272 ft.
Rexal Oil Co.'s No. 3 McLean, east flank	Rigging up to pump 5,170 ft.
Rexal Petroleum Co.'s No. 1 Smith (east)	Comp.; flowing estimated 80 bbls. daily; stopped.
Sinclair Oil & Gas Co.'s No. 2 Wilburn, southeast	Spudded.
Sinclair Oil & Gas Co.'s No. 1 McKinney (workover)	Milling out to sidetrack.
Sun Oil Co.'s No. 2 McKinney (southeast)	Set screen 5,439 ft.
Sun Oil Co.'s No. 1 Wilburn (southeast)	Drlg. hard sand and shale showing oil 5,377 ft.
Sun Oil Co.'s No. 2 Wilburn, southeast	Drlg. sand and lime 5,244 ft.
Sun Oil Co.'s No. 3 Wilburn, southeast	Drlg. shale 2,365 ft.
Sun Oil Co.'s No. 4 Wilburn (southeast)	Location.
Sun Oil Co.'s No. 2 J. Wilburn (southeast)	Derrick.
Sun Oil Co.'s No. 4 Chambers (south)	Rig.
The Texas Company's No. 1 Lawrence	Oil sand 5,260 ft.
Yount Lee Oil Co.'s No. 9 Chambers, south	Comp. flowing 1,900 bbls. oil 4,841 ft.
Yount Lee Oil Co.'s No. 10 Chambers (south)	Rig.
Yount Lee Oil Co.'s No. 4 Woodward, southeast	Set 133 ft. screen to test 5,347 ft.
Yount Lee Oil Co. No. 5 Woodward, southeast	Drlg. sand and lime 4,599 ft.
Yount Lee Oil Co.'s No. 1 Phillips	Drlg. shale and lime 4,512 ft.

BOLING—FORT BEND AND WHARTON

Houston Gulf Gas Co.'s No. 1 Fields (northwest)	Rig

RACCOON BEND—AUSTIN COUNTY

Humble & Valley's No. 5 Austin College	Derrick.
Humble & Valley's No. 3 Beal	Cemented 6⅝-in. csg. to test oil sand 3,218 ft.
Humble & Valley's No. 3 Buchanan	Derrick.
Humble & Valley's No. 6-A Walton	Swabbing 3,364 ft.
Humble & Valley's No. 7-A Walton	Derrick.
Humble & Valley's No. 8-A Walton	Derrick.
Humble Oil & Refg. Co.'s No. 8-B Deutrich	Pumping mud to kill gas pressure 1,090 ft.
Humble & Valley's No. 9-A Deutrich	Rig
Humble & Valley's No. 10-B Deutrich	Comp. flowing 400 bbls. oil 3,350 ft.
Humble & Valley's No. 11-B Deutrich	Derrick
Humble & Valley's No. 4 Woodley	Derrick.
Humble & Valley's No. 5 Woodley	Derrick.
Humble & Valley's No. 6 Woodley	Derrick
Humble & Valley's No. 5-B Grawunder	Derrick.
Humble & Valley's No. 6-B Grawunder	Drlg. sand, shale and shell 3,125 ft.
Humble & Valley's No. 7-B Grawunder	Drlg. sandy shale 3,117 ft.
Humble & Valley's No. 10-B Grawunder	Derrick.
Humble & Valley's No. 4-C Grawunder	Cmtd. csg. to test oil sand 3,090 ft.
Humble & Valley's No. 3 Helmuth	Derrick
Humble & Valley's No. 3 Jackson	Derrick
Humble & Valleys No. 1-B Machamehl	Derrick
Humble & Valley's No. 6 Urban	Rebuilding rig 3,086 ft.
Humble & Valley's No. 7 Urban	Derrick.
Humble & Valley's No. 8 Urban	Location.
Humble & Valley's No. 5 Saunders	Derrick.
Humble & Valley's No. 6 Mueller	Rigging up to pump 3,270 ft.

(Continued on Page 206)

Starr County Has Promising Well

The Texas Company Test Has 2,300 Feet of Oil in Hole. Darst Creek Area Has Dozen Tests. New Gasser in Bee County

By B. D. Stevenson
Staff Correspondent, Southwest Texas Fields

SAN ANTONIO, Tex., Dec. 2.—With a dozen or so wells drilling and rigging up in the Darst Creek Field by eight different operators, two of them major companies, it appears that more attention is being given to the development of Darst Creek than to the proration of the production of that field. The fied is still the center of interest in Southwest Texas but the discovery of a new gas producing spot in Bee County and the strong probability of a new oil producing territory in the lower part of Starr County with The Texas Company's No. A-4 V. G. Guerra standing 2,300 feet in oil and a serious movement on the part of independents in the San Antonio territory to organize, were features that were also receiving attention.

Darst Creek Field

In addition to its 17-acre lease in the heart of the Darst Creek Field the Turman Oil Co. of Fort Worth also has a narrow strip at the south end of the field adjoining the Dallas Wilson farm on which the discovery well is located. He has made application for a permit to drill this and his application is pending at Austin. His nearest location would be only about two regular locations south of the discovery well. It makes a very serious situation in that end of the field. If Turman gets the permit it will necessitate the Humble and Texas each starting offsets at once.

Magnolia Petroleum Co. has five tests advanced to the stage of having the derrick up and some are drilling, including the No. 1 Rand Miller which is shut in, but really is a completion. Turman Oil Co. has several tests started; Gulf Production Co., Kirby Petroleum Co., United North & South Development Co., O. W. Killam, Mundine Investment Co. and Trinity Drillers each have one well drilling. The latter close to Edwards lime as this was written and the Turman Oil Co. is far advanced on one test, being below 1,600 feet in No. 1 Rand Miller. Magnolia Petroleum Co. in addition to drilling offsets around its No. 1 Rand Miller has made a location for the No. 1 A. M. Baker near its No. 1 R. C. Appling which came in in the early days of the field estimated at about 4,000 bbls., but has been shut in ever since.

Starr County Oil Well

The Texas Company's No. 4-A V. G. Guerra in the lower part of Starr County, in sand at 3,506-66 feet and standing 2,000 feet in oil of 35 gravity, is one of the big things of the week in Southwest Texas. This test is 4 miles north of Roma. It is in Porcion 67 of the Jurisdiction of Mier and is about 5 miles from the south end of the porcion and about 7 miles from the north end and about the center east and west. The Texas Company some months ago got a gas well of 1,000,000 feet or more at shallow depth and later encountered gas in other tests. It has been wildcatting that territory several years to develop a structure and it looks now as though it has it. Southern Exploration Co. which blocked the acreage originally and The Texas Company which owns a half interest are the sole owners and with no leases available near the well, so there will be no wild scramble for starting tests in that part of the country. The location is 25 miles due south of the Chareo Redondo Pool in Zapata County and since the structures or folds in that country take a north and south trend there is a possibility that this test may attract wildcatters to try their luck on the same general trend north with the idea of picking up other producing spots.

New Bee County Gasser

C. F. Nichols' No. 2 Hicks, several miles south of the Pettus gas field in Bee County, at about 2,000 feet in depth found a sand that developed gas with 200 pounds rock pressure and later this increased to around 450 pounds. It looks like a pretty good chance for another gas pool, the second, in Bee County. It is located a few miles north of Beeville. Nichols has been wildcatting in that territory for some time but had been shut down for months till the Pettus gas well came in and this revived interest in his location.

Brooks County

Houston Oil Co. is nearly down to the sand in its No. 1 Wormser-Holbien in Brooks County, 600 feet south of its No. 1 Lasater which came in at 4,115 feet some weeks ago, a gasser with the gas carrying considerable oil moisture. The Humble Oil & Refining Co. and Shell Petroleum Corp.'s No. 1 Singer, located a few miles south of this in the Alta Verde Subdivision has spudded in. This is probably a separate structure and some think more highly of it than of the one proven productive by the Houston Oil Co.'s No. 1 Lasater.

Very little of interest has transpired in the Pettus area in the past month. Mission Drilling Co. is starting its No. 5 Ray in Bee County near No. 2 which came in a gasser. F. P. Zoch's No. 1 Kauffman in Goliad County, located some miles to the east, is down around 4,000 feet and drilling.

Agua Dulce Field

Agua Dulce Oil & Gas Co. tried to develop another sand in the field in Nueces County but failed to get production. It drilled No. 1 Ollie Purl to 2,300 feet in an effort to pick up a sand that had a showing in No. 1 Ed Allen, located farther east. It found the sand alright with broken shale and with quite a little gas in it and free from water. It will pull back to the sand topped in the discovery well at 2,013 feet and try to make a well there. It offsets two producers at that depth.

Production

Daily average production during the past week follows:

Branyon	21
Bruner	32,502
Dale	475
Darst Creek	1,563
Kingsville	350
Larremore	138
Luling	10,075
Lytton Springs	887
McMullen County	30
Medina County	24
Mirando	9,960
Somerset	1,766
Yoast	1,169
Total	58,951
Week ending November 23	59,907
Decrease	956

Laredo District

Thirteen new locations were made in the Laredo district last week. These with the indications that The Texas Company's No. 4-A V. G. Guerra in lower Starr County would make an oil well, were the features of that district. Killam-Duggan completed their No. 10 Cuellar in Zapata County east of the Jennings gas field at 1,596 feet for 150 bbls., another good well in the second sand of that field.

Magnolia Petroleum Co. completed its No. 3 F. G. Martinez in Zapata County some distance south of the Henne, Winch & Fariss Pool. Depth is 1,876 feet and it came in for 20,000,000 feet of gas. This is a west offset to its No. 1 which opened a new gas pool in that territory in a sand at around 1,900 feet and which may be a different sand from anything producing in the Mirando district. Southern Exploration Co. recently completed its No. 6 Joe Jennings a mile south of these two Magnolia gas wells and got a good gas well but at shallower depth.

Seven of the new locations in the Laredo territory are in the territory of one or the other of the Cole Pools in Webb and Duval. Magnolia Petroleum Co. made three new locations in the gas area north of the Cole oil pool in Webb County and two in the Cole gas pool in Duval County. Magnolia Petroleum Co. also made two new locations on the F. G. Martinez land in Zapata County south of the Henne, Winch & Fariss Pool. Alworth-Stevens have made location for the No. 1 Garza in Survey 40 just south of the Alworth Pool in the western edge of Jim Hogg County where production is at 1,000 feet.

Harry L. Fansler has made location for his No. 1 Cuellar in the Jennings gas field.

Shell Abandons Wildcat

Shell Petroleum Co. has abandoned its No. 2 Lopez in Zapata County north of the Charco Redondo Pool at 1,114 feet, dry.

Trussell-Partee have abandoned their No. 1 Hagist in northwestern Duval County west of the Schoolfield-O'Byrne Pool. Total depth reached was 2,435 feet. It had a little encouragement in the way of some showings of oil and gas.

WILDCAT OPERATIONS IN SOUTHWEST TEXAS

Week ended November 30

BASTROP COUNTY

T. C. Hadley's No. 1 F. Kiel, R. H. Grimes Sur., 150 ft. E line, 1 000 ft. S line ..... Drlg. 3,735 ft.
Johnson Brother's No. 1 W. C. Bryan, Stidham Sur., 5 miles W from Red Rock ..... Spudded in.
R. L. Batts et al's No. 1 A. L. Alexander, W. M. Eastland Sur., 1,350 ft. from W line, 750 ft. from S line ..... Drlg. in shale 940 ft.
Humble Oil & Refining Co.'s No. 1 C. W. Corbell, J. G Lentz Sur., 150 ft. to NE line of lease, 4 miles N from Red Rock ..... Location.
Owens et al's No. 1 Goodman ..... Top Buda; shut down 2,540 ft.

BEE COUNTY

Houston Oil Co.'s No. 1 McKinney, L. C. Randolph Sur. ..... Drlg. in shale 2,975 ft.
The Texas Company's No. 1 Tipps, C. Clark Sur., 150 ft. from S and W lines of Blk. 45 ..... Abandoned in shale 911 ft.
The Texas Company's No. 2 Tipps ..... Location.
Nichols et al's No. 2 Hicks in Jose Maria Uranga Survey, 600 feet to N. line, 2,000 feet to W. line ..... T. D. 2,000 ft.; swabbed in for small gas well.

BEXAR COUNTY

Guy G. Fisher's No. 1 S. L. Beck, P. W. Hays Sur. ..... T. D. 1,002 ft.; shut down.
F. H. Eckert's No. 1 Sandemer, Sur. 52 ..... Drlg. 615 ft.
Penn-Tex Oil Co.'s No. 1 Kate May, F. R Desauge Sur. No. 134 ..... Drlg. in top of Eagleford shale 1,884 ft.
Ross E. Fenton Co.'s No. 1 Clarence V. Uhl, 150 ft. to S and W lines, 6 miles SE from San Antonio ..... Location; failed to get water well arranging to lay a water line.
Moore-Jauer's No. 1 Holly R. Ellison ..... Drlg. 1,803 ft.
Leon Oil Co.'s No. 1 Reiniger, 300 ft. E line, 215 ft. S line ..... Drlg. in lime 1,675 ft.; T. C. 1,350 ft.; top Edwards 1,670 ft.
E. G. Potter's No. 1 Watson, B. Martinez Sur. ..... T. D. 2,509 ft.; bailing every other day.
W. C. Sutherland's No. 1 J. Halberdier, Survey 57, located 150 E of Cen of W. line ..... Location.

BLANCO COUNTY

Ashe & Marshall's No. 1, 5 mi. S Johnson City ..... Survey corrected; erecting National rig.

BROOKS COUNTY

Amos Dinn, Trustee's No. 3 Garcia-Ramosi, share B-1, Las Mestenas y Gonzales grant, 1300 ft. S line, 2,325 ft. W line of share B-1 ..... Drlg. 1,100 ft.
Humble Oil & Refining Co. & Shell Petroleum Co's No. 1 Ringer, Alta Verde Subd., 2,500 ft. S of N line, 333 ft. W of E line of Sec. 312 ..... Location.
W. G. French's No. 8 Riley Allen, C Blk. 37, Nesslip Subdivision of Allen Ranch, NE part ..... Drlg. 2,800 ft.

(Continued on Page 205)

COMPLETIONS PRODUCERS

Henne, Winch & Fariss—Zapata County

Magnolia Petroleum Co.'s No. 3 F. G. Martinez, 660 feet feet N line, 660 feet E line of W half, Survey 6, set 12½-inch casing at 99 feet, set 8⅛-inch casing at 1,872 feet, sand at 1,872-76 feet, total depth 1,876 feet, 20,000,000 feet gas.

Jennings Pool—Zapata County

Killam-Duggan's No. 10 Cuellar, Survey 277, 3,175 feet E line, 1,880 feet S line, set 6⅝-inch casing at 1,593 feet, sand at 1,593-96 feet, total depth 1,596 feet, 150 bbls.

ABANDONED TESTS

Wildcats—Zapata County

Shell Petroleum Co.'s No. 2 Lopez, Block 11, Survey 288, 660 feet NW line, 660 feet SW line, total depth 1,114 feet, abandoned.

Randado Pool—Zapata County

Magnolia Petroleum Co.'s No. 1 Hinnant, Block 1, Survey 20, 600 feet N line, 600 feet W line, set 12½-inch casing at 99 feet, total depth 2,992 feet, abandoned.

Henne, Winch & Fariss—Zapata County

Magnolia Petroleum Co.'s No. 2 F. G. Martinez, Survey 6, 660 feet N line, 660 feet E line, set 12½-inch casing at 342 feet, sand at 2,079-80 feet, tested small show of oil, total depth 2,150 feet, temporarily abandoned.

Wildcats—Duval County

Trussell & Partee's No. 1 E. R. Hagist, Block 7, Survey 271, 450 feet E line, 750 feet S line, sand at 1,535-38 feet, tested salt water, oil and gas; sand at 2,252-56 feet, tested gas, oil and salt water; total depth 2,435 feet, abandoned.

NEW LOCATIONS AND OPERATIONS

Carolina-Texas—Webb County

Foster Barnsley's No. 7 Webster, Survey 684, 750 feet E line, 510 feet S line, of NE of SW of survey, total depth 101 feet, set 10-inch casing at 100 feet, drilling.

Jennings—Zapata County

Harry L. Fansler's No. 1 F. Cuellar, Survey 285, 150 feet W line, 1,170 feet N line, rigging up.

Alworth Pool—Jim Hogg County

Alworth-Stevens' (Charles B. Stevens')

(Continued on Page 208)

Nine Active Operations in Lea County

Drilling Being Resumed on Moffat Dome, Colorado. Deep Test in Old Boulder Pool. Two Abandoned in Osage Field

By Tolbert R. Ingram
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., Dec. 3.—Rocky Mountain operations revealed no outstanding features the past week, the few completions reported being average wells. In southeastern New Mexico, the Humble Oil & Refining Co.'s No. 1 Bowers, 3 miles ahead of production in the Hobbs Pool, has mudded off 50,000,000 feet of gas and is drilling deeper. The Lea Pool in the center of Lea County, has nine active operations under way, most of which are around Cranfill & Reynolds' No. 1-B State which is producing 2,000 bbls.

Drilling on the Iles Dome by the Midwest Refining Co. and on the Moffat Dome, both in Colorado, is being resumed each starting a well. Several Colorado wildcats are already shutting down for winter. The Reliance Oil Co. is starting a deep test in the heart of the old Boulder Pool which will go below the producing horizon drilled many years ago.

Two wells abandoned in the Osage Field and one producer in that area marked the completions in Wyoming.

NEW MEXICO

The Humble Oil & Refining Co.'s No. 1 Bowers, C NE SE Section 30-18-38, Lea County, New Mexico, 3 miles northwest of the discovery well in the Hobbs Pool, has been showing up favorably for some time. At a total depth of 2,788 feet it was making approximately 10,000,000 feet of gas. There was more gas at 2,810-20 feet, the total estimated at 12,000,000 feet, followed by a show of oil at 3,143-49 feet. At 3,368 feet, total depth, it was given a short test and made approximately 25 bbls. an hour. Later it made 438 bbls. in 24 hours. At a total depth of 3,404 feet, it made 372 bbls. in four days and then at 3,684-87 feet it struck a gas horizon making approximately 50,000,000 feet. At last reports it was drilling at 3,721 feet in anhydrite and lime, not yet as deep as the producers to the southeast. The Ohio Oil Co.'s No. 1 State, NE SE SW Section 9-19-38, about a mile west and southwest of the Hobbs producers, was drilled to a total depth of 4,312 feet, where it had a hole full of sulphur water, and is plugging back to 4,230 feet to test a sand at 4,150-4,208 feet which swabbed 260 bbls. of oil in four days. The Midwest Refining Co.'s No. 24 State, NE SE SW Section 10-19-38, is drilling at 2,905 feet in anhydrite and red beds, and its No. 13 Terry, SE NE SW Section 10-19-38, is drilling at 2,007 feet in anhydrite, shale and salt. The Shell Petroleum Corp.'s No. 1 Thorpe, SW NW SE Section 10-19-38, is drilling at 2,663 feet in anhydrite after passing out of the salt at 2,655 feet, and its No. 1 Terry, SE SW NE Section 22-19-38, is drilling at 4,200 feet in lime. Harrison and others' No. 1 Tatum, NW SW SW Section 35-18-38, spudded on November 16, and is drilling at 250 feet in the red beds. The Midwest Refining Co.'s No. 6 Wright, NW cor. SW Section 14-19-38, has not yet commenced spudding.

Lea Pool

Heretofore wells being drilled in Township 20s-34e, and Township 21s-33e, have been referred to in these reports as the San Simion district, a designation generally in use in the earlier wildcatting operations, but which on most maps is now known as the Lea Pool. On some maps it has been designated as the Lynch area. This operation, the most active in Lea County, is approximately 30 miles to the northwest of the Jal Pool and 25 miles southwest of the Hobbs Pool. There are two producing wells, the Texas Production Co.'s No. 1 Lynch, NW cor. SE Section 34-20-34, and Cranfill & Reynolds' No. 1-B State, NE cor. Lot 7 Section 2-21-33. These wells are making around 3,000 bbls. a day, the oil being taken by the Texas Pipe Line Co.'s line into Winkler County, Texas. There are nine wells drilling in this area, most of them around the Cranfill & Reynolds well, and three offsets to be made. The sections in the north tier in Township 21 are 1½ miles long and the north two-thirds are divided into 16 lots starting with Lot No. 1 in the northeast corner. Operations in the Lea Pool, as it will hereafter be called, include the following: Cranfill & Reynolds' No. 2-B State, NW cor. Lot 9 Section 2-21-33, is drilling at 2,915 feet in salt, and their No. 3-B State, SW cor. Lot 9 Section 2-21-33, is drilling at 1,720 feet in the red beds. The Amerada Petroleum Corp.'s No. 1 State, SW cor. Lot 7 Section 1-21-33, is drilling at 1,735 feet in anhydrite, and the Continental Oil Co.'s No. 1 State, NW cor. Lot 12 Section 1-21-33, is drilling at 1,750 feet. This company also is about ready to start drilling its No. 2 State in this section. The Texas Production Co.'s No. 1-B State, SW cor. Lot 5 Section 1-21-33, is rebuilding rig destroyed by fire. Depth of hole is 965 feet with the 12½-inch on bottom. Same company's No. 1-A State, SE cor. Lot 8, Section 2-21-33, is drilling at 1,500 feet, and its No. 2-A State, SW cor. Lot 8 Section 2-21-33, is drilling at 1,500 feet. Snowden & McSweeney's No. 1 State, NW cor. SW Section 1-21-33, is drilling in a water sand at 1,030 feet.

Jal Field

The Jal Field in the southeastern corner of Lea County, in which is included wells drilling in Townships 25 and 26s, Ranges 36 and 37w, has the following operations under way: Humble Oil & Refining Co.'s No. 2-A Lindley, C SW SW Section 13-25-36, is drilling at 3,140 feet in lime, with a gas show at 3,106 feet, and the Empire Gas & Fuel Co.'s No. 1 Lindley, C NE SE Section 14-25-36, is drilling at 1,385 feet in anhydrite. To the north, Cranfill & Reynolds' No. 1 Cushing, SW SE NW Section 23-24-36, is drilling at 3,150 feet in lime. It had an oil show at 3,140 feet and approximately 250,000 feet of gas at 3,015 feet. The location is half a mile east and a little north of the same firm's No. 1 Meyer, a large gas well.

In the area to the east and northeast of the Lea Field, the Continental Oil Co.'s No. 1 A. E. Meyers, SW SW Section 17-21-36, is coring at 3,830 feet, and its No. 1 William Meyers, SW cor. NW Section 28-22-36, is shut down at 3,645 feet. Fisher & Lowrie's No. 1 State, NE cor. NW Section 11-18-36, is drilling at 1,780 feet in the red beds, and the Penn Oil Co.'s No. 1 State, NE Section 21-19-36, is bottomed at 3,449 feet in lime and swedging at 3,300 feet to straighten crooked hole. The Empire Gas & Fuel Co.'s No. 1 Closson, NW SE Section 6-22-36, is shut down for orders at 3,599 feet. The gas broke in from behind the 6⅝-inch. This was the second attempt to kill the flow of 110,000,000 feet of gas to drill deeper. The Texas Pacific Coal & Oil Co.'s No. 2 State, NW SW Section 21-23-36, has been put on the pump for a test at a total depth of 3,716 feet. It pumped 46 bbls. the first hour. The well is making an average of 240 bbls. a day natural. The Empire Gas & Fuel Co.'s No. 3-B State, NE SE Section 5-21-35, is drilling at 4,065 feet with a hole full of water at 3,935 feet.

Other Lea County operations include the following: Barnsdall Oil Corp.'s No. 1 Bronson, SE cor. Section 28-16-32, near Lovington, is drilling at 1,335 feet in the red beds, and A. D. Morton and others' No. 1 State, C NW Section 29-11-38, Tatum district, is drilling at 1,950 feet in a gray water sand. There were 800 feet of fresh water in the hole at 1,910 feet. The Rector Oil Co.'s No. 1 King, NE NE Section 26-25-32, southwestern corner of the county, is shut down for orders at 3,230 feet after sidetracking tools.

Eddy County

In Eddy County, the Etz Brothers' No. 1 Etz, C SE SE Section 13-16-30, in the district to the northeast of the Artesia Field, is drilling at 3,075 feet in lime. It had approximately 2,000,000 feet of gas at 2,670 feet and this increased to about 3,000,000 feet at 3,060 feet. Lockhart and others' No. 1 Parke, SE cor. Section 10-17-30, is drilling at 3,350 feet. It encountered a break in the lime at 3,310 feet and oil rose in the hole. The Grayburg Oil Co.'s No. 2 Keely, C SE NE Section 24-17-29, is bottomed at 3,082 feet in the lime and being tested. It made 350 bbls. in 24 hours from 3,065-70 feet. V. P. Welch and others' No. 1 State, SW cor. Section 27-17-28, is drilling at 690 feet in shale, and Naylor and others' No. 2 Danciger, NW cor. SW Section 18-17-31, is drilling at 3,080 feet in brown lime. Leonard & Levers' No. 1 Levers, NW cor. SE Section 21-17-29, is drilling at 2,502 feet in white lime. F. B. Van Horn's No. 1 Santa Fe, SE SE Section 18-19-26, northwest of Lakewood, spudded in and shut down, and Flynn, Welch & Yates' No. 57 State, NE cor. SE Section 19-19-28, is rigged and ready to spud.

In De Baca County, the Transcontinental Oil Co.'s No. 1 McWhorter, SW NW Section 6-3s-22, is bottomed at 4,770 feet in gray sand and fishing for tools. The Matador Oil Co.'s No. 1 Wood, SW SW Section 6-4n-20, is shut down for tools at 2,683 feet in red sand.

In Chaves County, the Cactus Petroleum Co.'s No. 1 State, SE cor. Section 14-10s-26, is drilling at 1,755 feet in shale, and the Star Oil Co.'s No. 3 Adams NE NE Section 25-17-17, is bottomed at 3,270 feet in lime and preparing to run the 6⅝-inch.

In Torrance County, the Sinco Oil Co.'s No. 1 Katchin, C NE NW Section 13-7n-7e, is reported abandoned at 302 feet.

San Juan County

In San Juan County, the Reserve Oil Co.'s No. 2 Shaffer, SE NE Section 1-21-14, Stony Butte, is bottomed at 780 feet (corrected) and underreaming the 6¼-inch to make a wate shutoff. An oil show was encountered at 715 feet and water came in at 725 feet. The Angel Peak Oil Co.'s No. 1 Garland, NE Section 11-28-11, Kutz Canon district, is bottomed at 3,050 feet in shale and sidetracking the 8¼-inch bit.

In McKinley County, the Phoenix Oil Co.'s No. 1, Section 13-18-10, is reported abandoned at 535 feet, and the Union United Oil Co.'s No. 1, NE cor. Section 30-14n-9w, was abandoned at 400 feet. Kern & Toler's No. 1 Branson, SE NW Section 16-17-11 (corrected) was dry and abandoned at 390 feet.

COLORADO

Drilling operations in Colorado slowed down considerably on account of unfavorable weather. Some wells already have been shut down for winter. These include all of the Mountain Fuel Supply Co. wells on the Hiawatha, Powder Wash and Bartram Domes in northern Moffat County. The Midwest Refining Co. is starting one well on the Iles Dome and the Texas Production Co. one well on the Moffat Dome, neither companies having done any drilling on these structures for several months. The Midwest's operation is its No. 19-SD Parkinson, NW SW NE Section 22-4n-92, an offset on the east to its No. 24-SD Parkinson, a producer. The Texas Company's Moffat Dome well is its No. 12 Knowlton, 330 feet from the north line and 330 feet from the east line, Lot 17, Section 33-5n-91. This puts it in the SW SE of the section and it is 660 feet north of its No. 4 Knowlton, which was drilled to the Sundance earlier in the year and completed in that horizon as a producer. The only other active operation in the Iles district is Thomas McLaughlin and others No. 1 Williams, NW SW Section 2-3n-92 which is testing the fault block between the Iles and Thornburg Dome. It is on top of the Sundance, the objective horizon, at 4,380 feet and is straightreaming to lower the 4¾-inch from 4,231 feet to bottom. In the northern part of the county, the Texas Production Co.'s No. 1 Berlin, SW NE Section 19-12n-100, Bartram Dome, is making hole at 2,060 feet after cementing off a gas sand topped at 2,002 feet.

The wildcat on the Fort Morgan anticline in Morgan County, northeastern Colorado, in which the Reiter-Foster Oil Co., the Indian Territory Illuminating Oil Co., the Osage Oil Co., and others are interested, again has been delayed. This test was due to get under way by November 15, but the state land board granted a 60 days' extension upon telegraphic request on account of the stormy conditions. From other sources it is learned contracts between the various interests have not yet been signed, but it is expected an agreement will be reached shortly. Location of the well has not yet been announced but it is expected to be on a state lease about 9 miles south of Fort Morgan.

Washington County

M. T. Smith & Sons' No. 1 Middlemist, SW SE Section 14-4s-56, in Washington County, on the southern extension of the Fort Morgan anticline, ran into cavy ground after setting the 15½-inch at 1,005 feet and had to underream and lower that string another 100 feet. The 15½-inch may be carried still deeper if the cavy ground persists as it is the intention of the operators to make a deep test and they want as large a hole as possible.

In Arapahoe County, the McDeb Drilling Co.'s No. 1 Fitzsimmons, NE Section 7-4s-66, is making much better progress than for many months and at last report was drilling at 4,390 feet in black lime and carrying the 6¼-inch. This well spudded in in 1926.

In Larimer County, the Continental Oil Co.'s No. 4 Scott, NE SE Section 6-9n-68, Wellington Dome, is drilling in at 4,393 feet. It is showing some oil and probably will be a producer. The Warner-Mosher Drilling Co.'s No. 1 Reed, SW NW Section 28-4n-69, Berthoud Dome, is shut down at 1,070 feet on account of the bad weather, and the Standard Oil Co. of Colorado's No. 1 Hertha, NW cor. Section 21-4n-69, is shut down for the 10-inch at 2,012 feet. Stanley Barrows and others' No. 1 Barrows, NW SE Section 7-11n-68, Round Butte Dome, is bottomed at 2,170 feet in the marine beds above the Sundance and is underreaming the 5⅞-inch.

The Reliance Oil Co.'s No. 1 Erickson, SW NE NW Section 33-2n-70, in the center of the old Boulder Field, has commenced spudding. Nine or 10 wells have been drilled on this section, but none went as deep as this test is intended. One of

BUSINESS IS GOOD

For the first time in its history the petroleum industry enjoys a self-imposed balance between supply and demand.

With faith that this intelligent, co-operative spirit will continue I expect 1930 to be a very good year.

There should be a large increase in gasoline consumption in 1930.

Stock market fluctuations will have little effect on the industry, one way or the other.

Stocks of sound, integrated oil companies are selling far below their real values.

Earnings of Skelly Oil Company this year have been satisfactory and have provided a substantial addition to the surplus fund after the payment of dividends.

Its principal quality products — natural gasoline, Refractionated gasoline, Aromax gasoline, Tagolene Motor Oils, Skelgas, Aerodynamic gasoline and Airplane oil—are all firmly established and enjoying the approval of the public in our marketing territory, as evidenced by constantly increasing sales.

As to the effect upon Skelly Oil Company of the recent sharp break in the prices of securities on the New York Stock Exchange, suffice it to say that the whole number of our stockholders has increased by 15 percent in the past three months.

We are deeply grateful to stockholders, employees and customers—wherever located—who had a part in making the year now closing one of outstanding public service for the company.

The management of the company dedicates itself, without reservation, to the job of building, with this continued support and help, a stronger and more serviceable company.

W. G. SKELLY,
President, Skelly Oil Company

the old wells drilled in 1908 averaged 14 bbls. a day from horizon at 2,446 feet for the first 21 months. Another made 86 bbls. a day average first 15 months and another did better than 70 bbls. at a total depth of 2,472 feet. The Midwest Refining Co. drilled to 2,920 feet in the same section several years ago, but did not go below the water found in all of the wells below the oil. The Reliance company is planning to go to 4,000 feet. East of the Boulder Field, the Hoover Oil Co.'s No. 1 Hoover, NW NE NE Section 26-1n-70, is shut down for winter at 3,000 feet. It has had several small shows of oil and gas.

Las Animas County

In Las Animas County, in the southern part of the State, the American Helium Oil & Gas Co.'s No. 1 Bolling, SW NW SW Section 3-29s-60, on the Thatcher Dome, is spudding for an 800-foot test for helium gas. This company was organized by Rocky Ford and La Junta men with C. L. Wood, president; and N. L. Bolling, secretary. The location is about one mile southeast of the Helium Co.'s No. 1 Keith, NW cor. Section 4-29-60, which is being abandoned after encountering water at 1,050-62 feet. The Helium Co.'s No. 1 Hall, NW SE SW Section 19-27-59, Delhi Dome, is rigging up pumping plant preliminary to spudding.

In Huerfano County, the Parker Club, Inc.'s No. 1 Fee, Section 4-28s-68, Badito-Alamo Dome, joint with the Kinney-Coastal Oil Co., is drilling at 3,844 feet and feeling for casing seat to set the 5⅛-inch. This well is close to the Dakota sand and continues to show considerable gas through water.

In Custer County, the Slevin Oil Co.'s No. 5 Slevin, NE NE Section 5-21-69, was drilled to 2,955 feet, entirely in the Pierre shale. The 8¼-inch, which was landed on bottom has been pulled and 50 feet of 10-inch left in the hole so that drilling may be resumed later on. There was a show of oil at 1,700 feet, but otherwise the hole was dry.

In the Canon City Pool in Fremont County, the Continental Oil Co.'s No. 2 Empire Zinc, SE NW Section 8-19-70, is rigging up.

In Jackson County, in the northwestern part of the State, the Midwest Refining Co.'s No. 21-X Rich, SW NW Section 9-6n-80, Buffalo Creek, is drilling at 3,345 feet in cavy sandy shale, and the Producers & Refiners Corp.'s No. 1 Hendershot, SE NE Section 2-6n-81, Pole Mountain, is drilling at 3,146 feet in dark limey shale with 2,100 feet of water in the hole. The 8¼-inch is at 3,133 feet.

In Routt County, the Texas Production Co.'s No. 3 Carstarphen, NE NW Section 5-6n-86, Tow Creek, is drilling at 3,435 feet.

In Rio Blanco County, the White Eagle Oil & Refining Co.'s No. 1-A Fordham, NW SW Section 9-2s-96, Piceance Creek, is standing at 2,815 feet with new rig completed and ready to resume, and the Texas Production Co.'s No. 1 Potter, C NE SW Section 30-2n-96, White River, is shut down at 5,413 feet on account of frozen water lines.

WYOMING

In the Oregon Basin Field in Park County, Wyoming, the Y-Tex Oil Co.'s No. 1, Section 16-51-100, is sidetracking casing at 1,025 feet, and the Oneida Oil Co.'s No. 1 Beck, SW cor. Section 28-52-100, is drilling at 2,010 feet. The Cody Petroleum Co.'s No. 1-B Klindt, NE SE Section 6-51-100, is drilling at 1,100 feet, and the Texas Production Co.'s No. 1 Sonners, NW cor. Section 29-51-100, is drilling at 2,825 feet. The Lenco Petroleum Co.'s No. 1 Morris, SW SE Section 20-51-100, is standing with the 6⅝-inch cemented on top of the Embar at 3,681 feet, and the California-Wyoming Oil Co.'s No. 1 Null, Section 26-51-100, is shut down at 500 feet. The Wyoming Western Oil Co.'s No. 3 Hough, SE SE Section 18-51-100, is drilling deeper at 4,220 feet. At 4,006 feet this well had a hole full of water in the Embar and it is drilling down to the Tensleep. Outside of Oregon Basin, the Cody Petroleum Co.'s No. 1 Polecat, SW cor. Section 22-57-98, is bottomed at 2,700 feet and fishing for collapsed casing. T. N. Clark and others' No. 2 SE SE Section 11-49-102, Spring Creek, completed several months ago at 3,908 feet in the Tensleep with a production of 75 bbls. initial of 16 gravity oil, is drilling deeper after filling all the storage on the lease.

In Big Horn County, the Producers & Refiners' No. 3, NW NW Section 24-56-98, Garland Dome, is drilling at 4,232 feet. The hole is making around 6,000,000 feet of gas. Considerable trouble has been caused by more than the usual number of fishing jobs. This is a joint operation with the Kinney-Coastal Oil Co. The Cody Petroleum Co.'s No. 1 Wilcox, NW SW Section 27-57-96, Cowley Dome, is drilling at 3,360 feet in the shale break between the Embar and the Tensleep. The Embar carried water. The Westland Oils, Inc.'s No. 2, NW NW Section 24-54-95, South Alkali Dome, is straightening crooked hole at 350 feet. and its No. 1, NE SE Section 33-55-95, is shut down after spudding. The Wisconsin Holding Co.'s No. 1, Lot 42, Section 10-55-97, Byron Dome, is drilling at 600 feet.

In Hot Springs County, the Midwest Refining Co.'s No. 8 Wagonhound, NW SE Section 6-44-98, is running the 8¼-inch at a total depth of 1,540 feet.

In Washakie County, the California Exploration Co.'s No. 1 Nowood, NW NW Section 31-48-89, is straightening a crooked hole at 2,080 feet.

Converse County

In Converse County, John Ackard's No. 2, at McKinley Switch, SW NE Section 28-31-69, is drilling at 3,412 feet and is reported to have a show of light oil. This well has been reported for some time to be in granite, but it is claimed this was granite wash and has been penetrated.

In Niobrara County, the Ohio Oil Co.'s No. 1 Converse Sheep, Section 32-36-65, Lance Creek, an old well to be drilled deeper to test underlying horizons, has completed rigging up.

Several completions in the Osage Field in Weston County are reported. These include the Osage Oil Trust Co.'s No. 1, SE Section 31-46-63, at 1,490 feet, dry; the Oregon-Wyoming Oil Co.'s No. 3, SW Section 34-46-64, dry in the Muddy sand at 1,570 feet; and Gerald Bock's No. 1, Section 11-46-64, a 10-bbl. well at 1,545 feet. The Gose Oil Syndicate's No. 1, NE cor. Section 28-47-63, near Thornton, is reported bottomed at 4,850 feet and having trouble rerunning the 4¾-inch.

In Carbon County, the Producers & Refiners' No. 2 Mahoney Dome, SE NW Section 34-26-88, is drilling in the red beds at 4,142 feet, and the Midwest Refining Co.'s No. 31 Dutton Creek, SW SE Section 1-18-78, is drilling at 2,300 feet in gray shale. The Red Feather Oil Co.'s No. 1, SW SW Section 35-13-92, Baggs structure, is drilling at 2,300 feet after topping a water sand at 2,010 feet. The Indian Petroleum Co.'s No. 1, NW NW Section 2-17-89, Miller Hill Dome, is reported plugged at 1,300 feet. The objective was the Embar at 1,800 feet. It was reported in the red beds at 995 feet. The Simpson Ridge Petroleum Co.'s No. 1, SW Section 34-22-80, cemented the 6¼-inch at 2,465 feet and will continue to the lower Mesa Verde. At this depth it had some waxy hard carbon.

Fremont County

In Fremont County, the Texas Production Co.'s No. 1 State, SW SW Section 36-34n-95, Alkali Butte, is bottomed at 153 feet and filling back to straighten. This is the third hole started, two others having been lost. The Kinney-Coastal Oil Co.'s No. 1 Dykeman, SE SW Section 22-3n-1w, Pilot Butte, is rigging up pump to mud off gas. Rig for drilling deeper has been completed. The Producer's & Refiners' No. 9, SW SW Section 15-32-95, Big Sand Draw, is bottomed at 2,978 feet with the 8¼-inch cemented at 2,734 feet. It is waiting for the cement to set. The well is bottomed on top of what is supposed to be the fourth Wall Creek sand of the Dakota series and making some wet gas of a different quality from that found in other wells on the structure. This is the deepest horizon so far drilled on the structure and the possibilities of obtaining oil below the big gas horizons are considered very favorable. There were reports that some oil was showing in this hole, and while it is hoped it will be found in the sand, the gas being very wet, so far these are erroneous. The Premier Oil Co.'s No. 1, SE Section 7-28-92, Crooks Gap, is drilling at 1,100 feet in the Niobrara shale. This operation sometimes goes under the name of Wood and Akridge.

In Lincoln County, the Midwest Refining Co.'s No. 1 Little Grays River, again is making hole at 1,717 feet. The Italo-American Petroleum Corp.'s No. 1 Neill, SE NW Section 14-24-113, also known as the Zier Oil Co., in which H. Allen Rispin and B. E. Taylor were reported interested, is shut down at 220 feet. A co-operate company with Sheriff McIlvain at the head, is reported being formed to complete the test. It is on the Fontennelle structure. Reeves Aylmore's No. 1 Higgins, NE NW Section 7-21-119, Sage Dome, is drilling at 1,300 feet and just entering the petroliferous shales of the Bear River formation.

In Sweetwater County, the Mountain Fuel Supply Co.'s No. 1 Cappers, SW NE Section 2-19-104, North Baxter Basin, is recementing the 13⅜-inch on top of the Frontier at 2,495 feet, and its No. 1 Union Pacific, Section 13-19-104, is drilling at 250 feet. Same company's No. 1 Pat Sullivan, SW SW Section 10-16-104, South Baxter Basin, is drilling at 2,775 feet, and its No. 1 Hay, NE NE Section 26-17-104, is standing cemented at 3,503 feet, on top of the Dakota. The same company's No. 1 Tucker, NW SE Section 18-13-99, Alkali Creek, is shut down for the winter at 3,630 feet.

In Sublet County, Charles S. Hill and others' No. 1, NW Lot 2, Section 3-26-113, La Barge Field, topped the pay at 853 feet and casing is being cemented. Two more wells will be started at once. The Piney-La Barge Oil Co.'s No. 1, Section 12-28-114, Dry Piney, is at 810 feet and shut down to case. Considerable oil is showing.

IDAHO

The Grand Teton Oil Co.'s No. 1 Blevins, SW Section 33-5n-44, Horseshoe Dome, Teton County, is waiting for cement to harden after setting the 12½-inch at 1,348 feet. The well has had shows of gas and oil in several horizons.

The California Co.'s No. 1 Sorensen, NW SW Section 33-3n-41, Meadow Creek, Bonneville County, is drilling out tubing and cement at a total depth of 3,550 feet. Just above this horizon it encountered an asphaltum residue. The hole is bottomed in the top of the Embar.

The Monida Oil Co.'s No. 1 Rose, NE Section 32-14n-36, Beaver Dome, Clark County, is drilling at 635 feet in an 18-inch hole in sandy limestone believed to be the Portneuf, of the Thaynes group.

UTAH

The Utah Southern Oil Co.'s No. 1 Frank Shafer, NW NE Section 6-27-21, Cane Creek Dome, San Juan County, Utah, is being plugged to abandon. This well was drilled by the Midwest Refining Co. and was known as the discovery well in the district south of Moab which started an extensive wildcatting campaign in 1927. It reached a total depth of 5,000 feet. When first brought in it made 5,000,000 feet of gas and 150 bbls. of oil at 2,028 feet, but it was found impossible to shut off water that came in below the oil and drilling continued. When the Utah Southern took over the well, good showings at lower horizons could not be saved and the hole was plugged back to the oil and gas at 2,028 feet. The well was a good producer as long as the channels could be kept open, but precipitation of salt in the pipe would clog it. The oil was found in a shale break in the salt beds. Another test nearby is planned by B. O. Jones and associates who were interested in several of these ventures.

The Continental Oil Co.'s No. 1 Boundary Butte, Section 22-43-22, San Juan County, has not yet succeeded in landing the string of special 3¾-inch casing on bottom at 5,570 feet. The casing is at 5,300 feet and the hole is being cleaned out. The Diamond Oil Co.'s No. 4, Sec-

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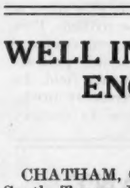
WELL IN SOUTH TURNER VALLEY ENCOUNTERS ADDITIONAL WET GAS

By Victor Lauriston
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, Nov. 30.—In the South Turner Valley Field, East Crest Oil Co.'s No. 1, LSD 5-6, Section 16-19-2w5, has encountered additional wet gas in the lime and will take production from this horizon while drilling. The test is around 40 feet in the lime at 4,352 feet depth, and is making between 4,000,000 and 5,000,000 feet of wet gas, with crude naphtha recovery estimated around 100 bbls. The wet gas has been blowing through the crude oil used with the oil-circulating rotary outfit, bringing considerable naphtha with it. East Crest's No. 2, LSD 4, is mudding off a heavy gas flow in the Dalhousie sands at 3,208 feet preparatory to fishing.



Among the Imperial tests in the South Turner Valley, Sterling Pacific Oil Co.'s No. 1, LSD 15, Section 33-18-2w5, got the Madison limestone at 5,153 feet and is now standing cemented in the lime at 5,168 feet. Sterling Pacific's No. 1 is one of the two farthest south tests in the Turner Valley Field, the other being Merland Oils' No. 1. It is approximately 4 miles south of the Home producers. Sterling Pacific Oil Co. holds 760 acres in the Turner Valley. The test got the lime apparently several hundred feet higher than Mayland Oil Co.'s No. 1, which got the formation at 5,441 feet, or Foothills' South West Petroleum No. 3, which reached the lime at 5,478. Both these tests are between Sterling Pacific's No. 1 and the Home producers.

In Mayland Oil Co.'s No. 1, LSD 10, Section 17-19-2w5, some gas was struck around 5,900 feet. It is now the deepest drilling test in the Turner Valley, though McLeod's No. 4 is deeper in the lime. The only test to actually reach greater depth was British Dominion's No. 1 in the central section, abandoned last year at 6,600 feet when a fault plane was struck.

Foothills Oil & Gas Co.'s No. 3 (South West Petroleum), LSD 16, Section 8-19-2w5, is 167 feet in the lime at 5,645 feet and in a hard capping formation, indicating production may be struck at a normal depth around 175 feet. Home Oil Co.'s No. 4, Section 20-19-2w5, at 5,427 feet, is rigging up to drill into production.

Imperial Oil, Ltd., is starting two new tests in South Turner Valley. Northwest-Associated's No. 2, LSD 6, Section 20-19-2w5, in the same section as No. 1 producer, is drilling at 244 feet. Royalite Oil Co.'s No. 24 is reported rigging up with cable tools just west of Lowery Petroleum's No. 1.

In the central Turner Valley, Imperial Oil, Ltd., has several tests in the lime.

South Turner Valley

In South Turner Valley, Commonwealth Petroleums' No. 2, LSD 7, Section 9-19-2w5, which was thought to have encountered a fault at 4,345 feet, has taken a gyroscopic-photograph survey revealing the trouble is with the hole and not the formation, the well being several hundred feet out of the perpendicular. Hole is now being straightened and is expected to get the lime at 4,300 feet.

Calmont's Nos. 8, 10 and 11, LSD 11, Section 20-19-2w5, are rigging up, and

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Curtailment Is Now Fully Enforced

California Operators Agree to Comply With Agreement. November Excess to Be Offset in December. Moratorium at Elwood

By L. P. Stockman
Staff Correspondent, California Fields

LOS ANGELES, Calif., Nov. 30.—The most important developments in California during the past week were the establishment of a drilling moratorium at Elwood and an announcement by Paul Grimm, Santa Fe Springs' umpire, that George F. Getty and the Wilshire Oil Co. had agreed to comply with the curtailment agreement, which both have heretofore only partially observed. The umpire's last statement showed that the Wilshire and affiliated companies produced 3,836 bbls. a day in excess of their allowable production at Santa Fe Springs during the first curtailment period and the same statement showed that George F. Getty ran 7,769 bbls. a day in excess of the allowable during the same period. The Wilshire agreed to shut in four producing wells and Getty one. The latter had already shut in 11 small producers and will have an even dozen curtailed as soon as present plans are carried out. With the acquiescence of these two operators to comply with the curtailment agreement, the situation at Santa Fe Springs is well in hand and a crisis has been averted. For a time it looked as though this conservation program might blow up, in fact several operators practically served notice that they contemplated a general resumption of activities unless all others observed their moral obligation to conform with the curtailment agreement. A resumption of production would of course, precipitate another drastic price cut.

Crude oil production at Santa Fe Springs has been well above the established maximum of 150,000 bbls. a day during the past two weeks due to the completion of new wells and the failure of Getty and Wilshire to fall into line. December will probably be a critical period in the curtailment program at Santa Fe Springs because of the excess production during November. Those companies which have failed to curtail in November will be expected to reduce their December output an amount equal to the November excess. The charging of November excess production against December production is necessary in order to balance the two periods as the curtailment agreement became effective November 1. This will reduce the allowable production for December to around 140,000 bbls. a day, although new completions will probably keep the actual production above 150,000 bbls. Deep zone development is bound to cause periodic fluctuations from day to day as new wells are completed and this condition will continue as long as there is no cessation of drilling. There are 238 strings of tools in operation at Santa Fe Springs with 71 new wells and deepening projects rotating ahead below the 7,000-foot level. A large part of these wells should be completed during the next 60 days. This tends to indicate that Santa Fe Springs will show a very high potential daily production around the first of the year. In addition to those below 7,000 feet, 53 more are making hole between 6,000 and 7,000 feet and 33 drilling ahead between 5,000 and 6,000 feet. This also indicates a sustained completion list up to at least March 1 of next year, after which completions should become a little less frequent.

Elwood Field Curtailment

Operators in the prolific Elwood Field of Santa Barbara County have mutually agreed to a drilling moratorium for 60 days and will, in addition, effect a further substantial curtailment in daily production beginning tomorrow, December 1. Paul Grimm, Santa Fe Springs' umpire, was selected as umpire at Elwood and will be in direct charge. A maximum allowable production of 30,000 bbls. a day was set by operators as Umpire Grimm's objective. This will necessitate a curtailment of about 10,000 bbls. per day. The moratorium is already in effect and will continue for 60 days, expiring on February 1, 1930. In conformity with this agreement, the Bankline, Barnsdall, Elwood Exploration Co., Pacific Western and Rio Grande agree to suspend drilling operations for 60 days and will post a bond of $100,000 each to guarantee the fulfillment of contractual obligations. No additional wells will be spudded in for 60 days and where projects are scheduled for completion within 30 days they will be suspended for a like period or longer if necessary to equalize the entire field so far as development work is concerned. The only exception is where offset wells must be drilled. This is the first time an iron bound contract has been worked out to curtail production activities in any California field. In contrast with previous agreements predicated on a moral obligation to curtail, contractual obligations of the Elwood agreement are enforceable in a court of equity with the additional protection of a performance bond. The suspension of development work and mutual curtailment of production has solved a very difficult problem because the large amount of drilling which was getting under way would have shoved Elwood's production well over 50,000 bbls. a day within a short time and it might have even topped the 75,000-bbl. mark.

TANKER SHIPMENTS FROM LOS ANGELES TO ATLANTIC AND GULF COAST PORTS

Commodity—	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Crude oil	.....	.....	.....	.....	997,250	2,988,419
Fuel oil	.....	.....	.....	.....	468,825	143,471
Diesel and gas oil	132,278	18,897	73,250	10,464	2,633,519	1,745,589
Gasoline	506,910	72,416	489,576	69,939	19,329,663	13,095,698
Kerosene	.....	.....	.....	.....	49,750	.....
Naphtha distillate	.....	.....	.....	.....	81,750	339,100
Coastwise—						
Crude oil	296,132	42,305	434,000	62,000	24,280,216	22,307,503
Fuel oil	567,794	81,113	155,314	22,188	18,163,171	15,795,283
Diesel and gas oil	38,856	5,551	8,642	1,235	1,182,684	1,074,144
Gasoline	297,329	42,476	130,421	18,632	19,176,359	8,771,077
Kerosene	.....	.....	.....	.....	70,286	66,757
Naphtha distillate	.....	.....	.....	.....	.....	239,071
Exports—						
Crude oil	152,245	21,749	139,584	19,941	5,650,631	1,958,932
Fuel oil	583,882	83,412	266,428	37,918	17,400,562	20,739,980
Diesel and gas oil	80,855	11,551	70,362	10,052	2,514,433	2,076,688
Gasoline	210,938	30,134	36,573	5,225	11,165,589	6,979,094
Kerosene	.....	.....	78,470	11,210	2,983,259	3,787,533

TANKER SHIPMENTS FROM SAN FRANCISCO TO ATLANTIC AND GULF COAST PORTS

Diesel and gas oil	.....	.....	.....	.....	.....	418,188
Gasoline	66,398	9,485	78,057	11,151	2,275,638	2,000,060
Lubricants	.....	.....	.....	.....	138,706	277,151
Coastwise—						
Fuel oil	31,788	4,541	73,618	10,517	2,830,377	3,140,475
Diesel and gas oil	.....	.....	.....	.....	360,538	279,197
Gasoline	132,016	18,859	174,307	24,901	4,805,394	4,466,652
Kerosene	7,993	1,142	2,510	359	199,396	224,643
Exports—						
Crude oil	.....	.....	.....	.....	121,603	96,250
Fuel oil	.....	.....	.....	.....	841,631	2,159,931
Diesel and gas oil	.....	.....	.....	.....	393,132	56,180
Gasoline	179,581	25,654	.....	.....	5,165,258	4,012,706
Kerosene	96,120	13,731	.....	.....	624,180	718,523
Lubricants	.....	.....	.....	.....	29,795	33,535

Santa Fe Springs

Deep zone exploration seems to be a favorite pastime among Santa Fe Springs operators and it looks like a foregone conclusion another productive horizon will be discovered below the lower Clarke now undergoing intensive development. From a geological standpoint the formation is favorable for additional discoveries below the Clarke zone on top of the structure and a producing well from 10,000 feet is not at all impossible. Several wells have been completed from the 8,000-foot level and 6 more are still drilling ahead below this point. The Richfield Oil Co. has just finished No. 5 Howard flowing 4,050 bbls. per day from 8,103 feet, and company officials are of opinion they could have taken in another 500 feet of hole with safety but took a 4,000-bbl. well from the 8,100-foot level and called it a good job. This well is the deepest producer at Santa Fe Springs but will probably not retain this distinction very long as several other operators are also heading for deep production. The deepest of these exploratory wells is Oscar Howard's No. 7 Hathaway, which is in a promising oil sand at 9,050 feet. This well has already passed through enough oil sand to warrant the expectation of developing commercial production, unless mechanical trouble develops. Other deep wells include the General Petroleum's No. 213 Santa Fe, at 8,230 feet. No. 191-F at 8,150 feet, Richfield's No. 3 Howard at 8,104 feet and The Texas Company's No. 10-A Patterson at 8,535 feet and No. 6 Weaver at 8,050 feet.

New Wells

New wells were not very numerous at Santa Fe Springs this week but operators should make up for lost time soon. The Texas Company recompleted No. 4 Wickman in the O'Connell zone at 6,828 feet and it is doing 95 bbls. per day on a compressor. This well cannot be carried any deeper because of mechanical limitations as it was finished with a 4¾-inch oil string. In addition to recompleting No. 4 Wickman, The Texas Company killed No. 5 Foix, which came in wet last week from 6,234 feet, and another cement job will be made tomorrow. The Standard Oil Co. also chalked up a recompletion this week but it too was rather unsatisfactory as it only made 335 bbls. per day after being redrilled and deepened from 7,910 feet to 7,947 feet. The Star Petroleum Co., which recently finished No. 4 Wardman flowing 5,250 bbls. daily from 8,024 feet, has decided to carry No. 2 Wardman down into the lower Clarke and deepening operations have been started at 6,250 feet. The General Petroleum, with 56 strings of tools, will probably finish 10 wells in the lower Clarke zone within a few weeks unless a last minute change is made and some of them carried on down. The Commodore Oil Co. is reaming two wells on the Landle lease and both should be tanking oil within 10 days. The Union and Wilshire should also finish two or more producers within 15 days.

The temporary voiding of curtailment work by the completion of new wells has resulted in the submission of a proposal by Umpire Grimm to delay future com-

MUSKEGON LEADS MOUNT PLEASANT IN COMPLETIONS DURING WEEK

By Special Correspondent

MUSKEGON, Mich., Dec. 3.—The Muskegon Field took the lead last week over the Mount Pleasant Field in completed oil and gas wells although in average daily production the Mount Pleasant Field retained its lead by about 1,000 bbls.

For the first time in many weeks more than 1,000 bbls. of initial production was added to the Muskegon Field by the completion of five new wells. One well with a flow of 650 bbls. was completed in the Dundee, the largest new well in three months.

Three of the new wells are in Muskegon Township but the two in Laketon Township were larger, making 300 and 650 bbls. initial, respectively. Four were completed in the Dundee and one was deepened from the upper to lower Traverse and shot. It will be produced from both Traverse pays.

The largest well was Nelson & Witt, Inc.'s No. 3-A George Fenner, NW SE, Section 11-10-17, Laketon Township. It flowed 340 bbls. the first 12 hours and was estimated good for 650 bbls. initial in the Dundee. Gas was struck at 2,052 feet and at 2,056 feet the well blew itself in with a flow of about 2,000,000 feet of gas and plenty of oil.

Witt and Wyant's No. 7 A. H. Fenner, NW SE, Section 11-10-17, also near the west end of the proven field in Laketon Township, made 300 bbls. initial with more than 1,000,000 feet of gas in the Dundee. Pay sands were struck at 2,052-61 feet.

Thompson Brothers and others' No. 3 Henry Smeltekop, NW SW, Section 5-10-16, Muskegon Township, north of M-20, was the largest of three small producers completed there. It is good for 50 bbls. in the Dundee at 2,041-50 feet.

The Fleeger-Ohlson Association's No. 2 Stanley Daniloff, SW SE, Section 5-10-16, swabbed about 20 bbls. of oil and as much or more water.

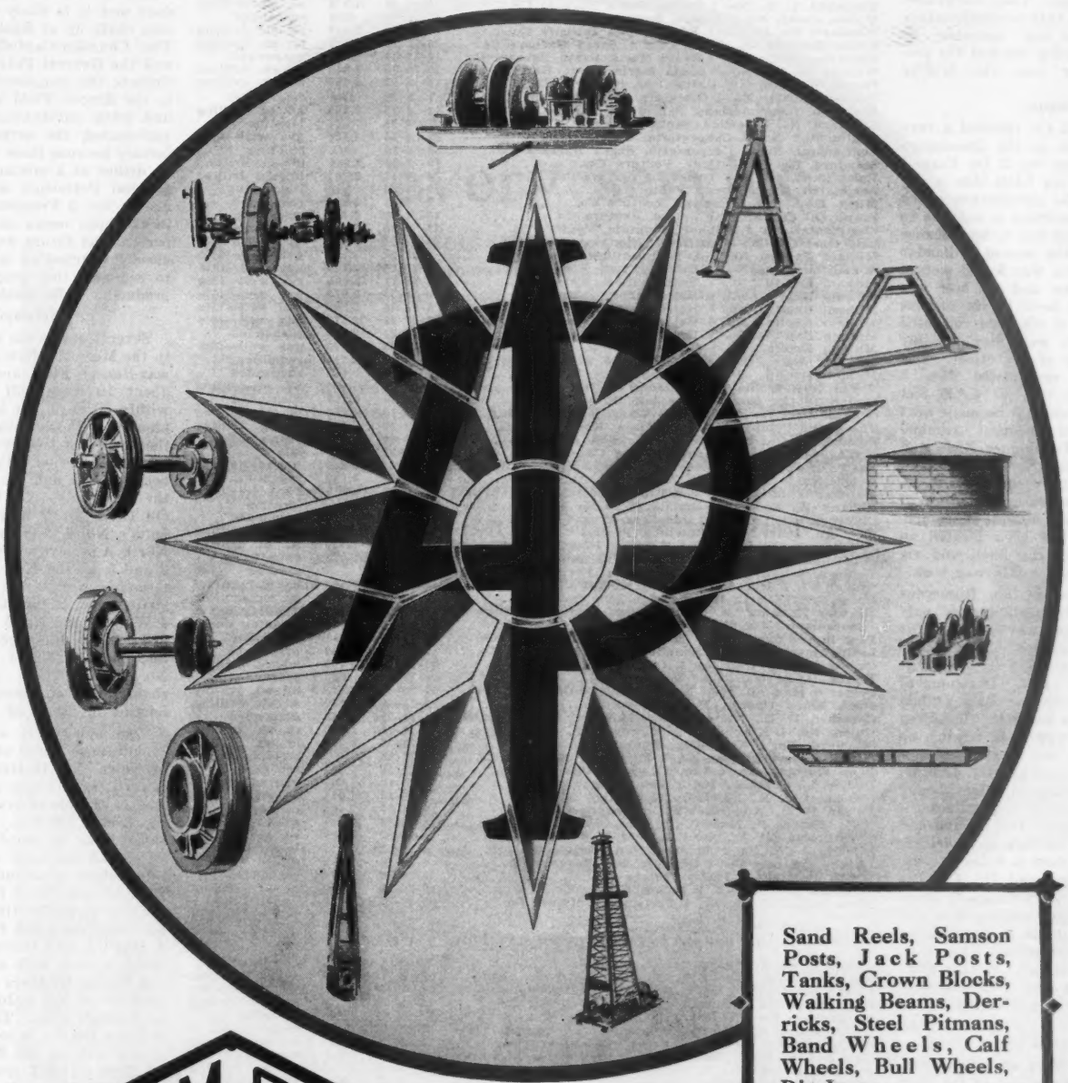
The Joliet-Morris Development Co.'s No. 1 John B. Nichols well, NE NW, Section 8-10-16, deepened from an original 500-bbl. upper Traverse well, was shot in the lower Traverse at 1,915 feet and is expected to make about 25 bbls. a day on the pump. It will be produced from both pays.

The Reed Oil Co. is moving in a rig for its No. 1 E. F. Plunkett, SE SE, Section 8-10-16, Muskegon Township. A rig also is being moved to the No. 1 Meurer estate well, NE SE, Section 8-10-16, Muskegon Township, to deepen it to the lower Traverse or Dundee. It is owned by the Muskegon Development Co., the Citizens and Lake Shore Petroleum companies.

No. 3 John Joldersma of the Central Gas & Oil Co., had a good show of oil

(Continued on Page 202)

On all points of the Compass



Sand Reels, Samson Posts, Jack Posts, Tanks, Crown Blocks, Walking Beams, Derricks, Steel Pitmans, Band Wheels, Calf Wheels, Bull Wheels, Rig Irons.

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pletions as long as possible. All the major companies have ratified the proposal and if it can be put into general effect it will go a long way toward stabilization of field production. The umpire's proposal reads as follows, "In order to successfully carry out your curtailment agreement of October 25, last, it seems that some action should be taken by operators to insure the orderly bringing in of these wells to the end that an excessive and burdensome amount of production be not brought in at any one time. It has been suggested casing be set on the sand that the well will produce from and then be left to stand until such time as conditions justify such well being brought on production. Time allowances could be arranged so that no disadvantage would work against any operator by virtue of his well having reached the producing sand sooner than other drilling wells."

Dominguez

The Associated Oil Co. finished a very important completion in the Dominguez Field this week when No. 3 De Francis was brought in flowing 1,100 bbls. a day from 4,520 feet. The significance which attaches to this completion is not due to the production secured but rather because it was finished in the second Callendar zone. The third zone was found wet in this well at 5,111 feet and the hole was accordingly plugged back to its present depth and a string of 6⅝-inch cemented at 4,325 feet. This well may possibly lead to the drilling of an offset. The Shell Oil Co. has recemented No. 3 Childs for the fifth time at 4,425 feet and another water test will be made next week. This lease is the most troublesome in the entire Dominguez Field and it will be recalled the Shell experienced considerable difficulty with water in its development work following discovery of this field by the Union several years ago. Another new well has been located on the Manual lease by the Shell and rig construction should get under way soon.

Drilling operations in the Rosecrans Field are practically negligible as only two drillers are under way. One is the Union's No. 11 Rosecrans down 5,950 feet and the other is No. 1 Trust of the Barnsdall at 4,550 feet. Development work in the Fullerton, or Brea Olinda Field is likewise at a low ebb. The Brea Canyon Oil Co., however, is rigging up rotary equipment on No. 47 and this new well will be making hole shortly. Drilling operations at Huntington Beach and Richfield have shown a slight increase during the past month. In the former area, operators are working on 8 drillers while in the latter field 9 holes are under way. The Arrowhead Oil Co. has just finished No. 1 Zuckerman at Richfield but it has not yet made a flow and consequently no estimate is available as to its potential production. The Continental and Union are also making preparations to finish a new well and both projects should be on production in the near future.

Elwood

The recent completion of several substantial producing wells out in the open ocean has greatly stimulated drilling operations in the Elwood Field and preparations were well under way toward spudding in several additional projects on tideland drilling permits when the moratorium was signed by operators. The Pacific Western Oil Co. had assumed an aggressive development campaign and preparations were completed to start three new wells on tideland drilling permit on No. 92 and another on the Goleta lease. Caroline Spalding's recent completion on tideland drilling permit No. 93 and the completion of No. 1 Goleta, a new well flowing 4,215 bbls. daily from 3,683 feet proved up a large part of the Pacific Western's Goleta lease and tideland permit No. 92 with the result that this company intended to capitalize on this proven acreage. The Barnsdall and Rio Grande were also rushing work ahead with a view of starting three new wells on the Bell Luton lease and another project on tideland drilling permit No. 88. The Honolulu Consolidated, operating as the Elwood Exploration Co., has just finished its initial completion on tideland permit No. 90 and rig construction was getting under way for a second well. The Bankline Oil Co. had also started making preparations to initiate additional work and the rig for well No. 2 on tideland permit No. 89 was nearing completion.

Ventura Avenue

There was only one well completed in the Ventura Avenue Field but a check indicates several potential producers should be tanking oil before the end of next month. The new producer was No. 11 Taylor of the Shell Oil Co. which came in under a natural flow doing 1,940 bbls. daily from 5,830 feet. The Bolsa Chica Oil Co. will probably list a potential producer during the next 30 days, as its No. 5 Hartman is in the oil sand at 7,065 feet with a projected completion depth at approximately 7,400 feet. This well has shown considerable oil and gas during the past 100 feet and the crew has found it necessary to use a heavily fortified rotary mud to prevent a premature blowout. The Shell is also working on several new wells on the Taylor lease which should be completed within 30 days and it is likely the Associated will also chalk up at least one new producer. The Chanslor-Canfield Midway Oil Co. and the General Petroleum each anticipate the completion of one new well in the Rincon Field within a few weeks, and while substantial production is not anticipated, the output should be satisfactory because these 4,000-foot wells can be drilled at a minimum of expense. The General Petroleum is making good footage in No. 2 Ferguson, being drilled out in the open ocean on a tideland drilling permit, and future work will no doubt be closely watched as it will be interesting to see how this project correlates with producing wells inside the shore line.

Midway-Sunset

Several new wells were spudded in out in the Maricopa flats section of the Midway-Sunset Field and a check indicates about 10 more will begin making hole within 30 days. It is likely also a large number of those wells now drilling below the 2,000-foot level will be completed during this period. Possible completions between now and the end of 1929 include the Barnsdall's No. 1-A Hazelton, Birch Oil Co.'s No. 2 Maricopa, Doyle Petroleum's No. 1 Son and No. 3 Weir, the North American's No. 5 Sunset and Nos. 2 and 5 on the Kerckhoff lease, the Rio Grande's Nos. 2 and 3 on the Havenstrite lease, Signal Oil & Gas Co.'s No. 4 Wallace and No. 5 Sheehan, the Standard's No. 3 Bonynge and No. 11 Fee in Section 8-11-23 and the Union Oil Co.'s No. 1 Son. These potential producers should show an average initial daily production in excess of 500 bbls.

Two new wells were finished in the Mount Poso Field of Kern County, one of which, No. 18 Glide of the Petroleum Securities, was shut in immediately. This well is capable of producing 100 bbls. per day from 1,750 feet. No. 19 Glide on the same lease is scheduled for completion within 15 days and will be shut in after establishing a potential. The other well finished was No. 2 Glide of the Shell in Section 15-27-28, finished as a 120-bbl. pumper from 1,499 feet. The Signal Oil & Gas Co. and Union will probably each finish a new well with 10 days and if the Vedder Brothers secure a satisfactory shut off in No. 1 Johnson this may also be finished soon. The Chanslor-Canfield Midway Oil Co. is moving in material for a new well on the Mon lease in Section 26-27-28 and will spud in its initial project in the Mount Poso Field within two or three weeks. In the Round Mountain Field the Shell is putting the finishing touches on No. 5 Freeman. The crew will be shifted to another location in the same field.

Fruitvale

Two new wells are scheduled to get under way in the Fruitvale Field of Kern County within 10 days and another shortly thereafter. The Western Gulf Oil Co., with No. 2-C on the Kern County Land Co. lease in the oil sand at 4,195 feet, is making preparations to spud in No. 10-B on the same property. The Standard has completed the rig for No. 5-3 on the Kern County Land Co. property in Section 24-29-27. The Mohawk has material on ground for a new well in Section 27-29-27. Drilling operations in the west front area reflect curtailment with only four wells under way. These are the Chanslor-Canfield Midway Oil Co.'s No. 29, General Petroleum's No. 11 Whetmore and the Richfield's

(Continued on Page 210)

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well, location—	S-T-R	Depth	Status
Union, No. 1 Buel Canyon, Santa Barbara Co.	X- 7-31	2,316	br. sh. drilling
Standard, No. 1 Point Conception, Santa Barbara Co.	X- 5-34	2,750	gr. sd. drilling
Standard, No. 1 Point Arguello, Santa Barbara Co.	35- 6-36	2,310	fishing
Gaviota Oil Co., No. 1 Lompoc, Santa Barbara Co.	9- 7-35	2,677	hd. sd. drilling
Calif. Oil Prop., No. 1 San Marcos, Santa Barbara Co.	8- 4-28	3,390	sespe-drilling
Carey, A., No. 1 Goleta, Santa Barbara Co.	1- 4-28	1,790	hd. sd. drilling
General Pet., No. 1 Goleta, Santa Barbara Co.	21- 4-28	4,533	gas well—idle
General Pet., No. 2 Goleta, Santa Barbara Co.	21- 4-28	2,891	redrilling
Oakburn Oil Co., No. 1 Capitan, Santa Barbara Co.	Tideland	mtl.	driving piles
Standard, No. 2 Goleta, Santa Barbara Co.	X- 4-29	1,011	sd. sh. drilling
Tannehill, L. B., No. 1 Goleta, Santa Barbara Co.	24- 4-29	4,275	sd. sh. drilling
McGee, Omar, No. 1 Goleta, Santa Barbara Co.	12- 4-29	Rig	suspended
Standard, No. 1 County Farm, Santa Barbara Co.	11- 4-28	1,298	sd. sh. drilling
Fields Gasoline Co., No. 1 Orcutt, Santa Barbara Co.	36-10-34	4,815	br. sh. drilling
Keystone Oil Co., No. 1 Santa Maria, Santa Barbara Co.	33-10-34	4,250	suspended
Wildcat Oil Co., No. 1 Santa Maria, Santa Barbara Co.	20-10-35	3,850	br. sh. drilling
Pacific Western, No. 1 Gibraltar, Santa Barbara Co.	14- 5-27	1,800	sd. sh. drilling
Gilmore Oil Co., No. 1 Gibraltar, Santa Barbara Co.	1- 5-28	Rig	rigging up
Shell, No. 1 Summerland, Santa Barbara Co.	18- 4-25	1,160	hd. sd. drilling
Standard, No. 1 Casitas, Santa Barbara Co.	26- 4-25	...	location
Continental, No. 1 Carpenteria, Santa Barbara Co.	33- 4-25	4,130	gas well—idle
Continental, No. 3 Carpenteria, Santa Barbara Co.	33- 4-25	mtl.	building rig
Standard, No. 5-9 Satticoy, Ventura Co.	10- 2-22	8,250	br. sh. drilling
Bolsa Chica, No. 1-A Temescal, Ventura Co.	4- 4-18	1,291	br. sh. drilling
Associated, No. 1 Rincon, Ventura Co.	19- 4-24	Rig	rigging up
Miley, E. J., No. 2 Casitas, Ventura Co.	7- 3-23	1,870	suspended
Frank Oil Co., No. 1 Filmore, Ventura Co.	35- 4-20	2,168	suspended
Continental, No. 3 Sulphur Mountain, Ventura Co.	21- 4-22	5,650	br. sh. drilling
Lockwood Oil Co., Well No. 1, Ventura Co.	28- 8-21	682	suspended
Milham Explts., No. 1-A Buttonwillow, Kern Co.	8-28-23	4,662	gas well—idle
Milham Explts., No. 2 Buttonwillow, Kern Co.	8-28-23	2,730	gas well—idle
Milham Explts., No. 3 Buttonwillow, Kern Co.	8-28-23	2,694	gas well—idle
Milham Explts., No. 4 Buttonwillow, Kern Co.	6-28-23	2,670	gas well—idle
Milham Explts., No. 5 Buttonwillow, Kern Co.	5-28-23	2,500	gas well—idle
Milham Explts., No. 6 Buttonwillow, Kern Co.	8-28-23	2,676	gas well—idle
Milham Explts., No. 7 Buttonwillow, Kern Co.	6-28-23	2,720	suspended
Milham Explts., No. 8-A Buttonwillow, Kern Co.	8-28-23	2,673	gas well—idle
Milham Explts., No. 9 Buttonwillow, Kern Co.	8-28-23	4,912	redrilling
Milham Explts., No. 10 Buttonwillow, Kern Co.	8-28-23	2,672	suspended
Elmer Oil Co., No. 1 Bena, Kern Co.	15-30-30	3,800	hd. sd. drilling
Elmer Oil Co., No. 1-A Rosedale, Kern Co.	33-29-26	5,260	suspended
General Pet., No. 1 Rosedale, Kern Co.	23-29-26	4,750	hd. sd. drilling
The Texas Company, No. 1 Edison, Kern Co.	23-29-29	3,500	sd. sh. drilling
Symark Oil Co., No. 1 Edison, Kern Co.	24-29-29	2,130	suspended
McVey, Max., No. 1 Jasmine, Kern Co.	23-25-27	Rig	idle
Shell Oil Co., No. 1 Lerdo, Kern Co.	5-29-27	6,150	hd. sd. drilling
Union, No. 2 San Emidio, Kern Co.	5-10-21	3,690	redrilling
Mallery, Willard, No. 1 San Emidio, Kern Co.	9-10-23	550	hd. sd. drilling
Eubank, E., No. 1 San Emidio, Kern Co.	11-10-24	...	location
Currency Pet. Co., No. 1 Jacalitos, Fresno Co.	28-21-14	2,606	suspended
Knudsen, John, No. 1 Jacalitos, Fresno Co.	14-21-14	915	bl. sd. drilling
Rio Grande Oil Co., No. 1 Kerman, Fresno Co.	14-13-17	3,830	sd. sh. drilling
Petroleum Securities, No. 2 Huron, Fresno Co.	28-20-16	6,828	swabbing
Western Gulf, No. 1 Penoche Valley, Fresno Co.	26-15-12	...	grading
Union, No. 1 Huasna, San Luis Obispo Co.	34-32-15	4,198	br. sh. drilling
Union, No. 1 North Huasna, San Luis Obispo Co.	12-32-14	4,980	gr. sh. drilling
Midwest Refining Co., No. 1 Huasna, San Luis Obispo Co.	34-31-15	2,212	cleaning out
Panorama Oil Co., Well No. 1, San Luis Obispo Co.	7-31-21	4,019	cleaning out
Paso Robles Synd., No. 1 Creston, San Luis Obispo Co.	27-27-11	3,742	suspended
Latin American, No. 1 Shandon, San Luis Obispo Co.	31-27-15	3,910	plug back
Colusa Oil Co., Well No. 1, Colusa Co.	31-15- 4	700	hd. sd. drilling
Kuhns, H. L., Well No. 1, Merced Co.	8-12-19	660	suspended
Foster & Hammil, Well No. 1, Alameda Co.	21- 3- 3	1,172	hd. sd. drilling
Shell, No. 1 Dudley, Monterey Co.	15-22- 9	5,170	sd. sh. drilling
Chessher, H. B., No. 1 Dudley, Monterey Co.	8-22- 9	245	suspended
Union, No. 1 King City, Monterey Co.	8-22- 8	2,490	rb. sh. drilling
Standard, No. 1 King City, Monterey Co.	23-22- 7	2,705	br. sh. drilling
Pacific Inland Oil Co., No. 1 Parkfield, Monterey Co.	19-23-15	mtl.	building rig
Penn Western, No. 1 Tulare Lake, Kings Co.	24-21-18	1,338	set pipe
Dudley Ridge Synd., No. 1 Tulare, Kings Co.	12-23-19	1,305	gas wl-shut in
O'Donnell, J. E., No. 1 Dudley Ridge, Kings Co.	7-23-20	1,911	sd. sh. drilling
Porter, H. B., No. 1 Devils Den, Kings Co.	9-24-17	2,406	br. sh. drilling
Getty, George F., No. 1 Button, Madera Co.	18-13-16	2,961	sd. sh. drilling
Twin States Oil Co., No. 1 Soldani, Mendocino Co.	14-12- 7	1,238	sd. sh. drilling
Elmer Oil Co., No. 1 Timbers, San Joaquin Co.	6- 3- 9	...	location
Barnhart Trust, No. 1 Oakdale, San Joaquin Co.	3- 2-10	2,453	sd. sh. drilling
White, Roy, No. 1 Pixley, Tulare Co.	8-23-26	2,377	suspended
Terminal Oil Co., No. 1 Tulare, Tulare Co.	29-20-25	3,920	br. sh. drilling
Terra Bella Oil Co., No. 1 Portersville, Tulare Co.	35-22-27	151	sd. drilling

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Ohio Oil Co., No. 1 Del Rey, Los Angeles Co.	21- 2-15	6,199	cemented
Marblehead Ld. Co., No. 1 Santa Monica, Los Angeles Co.	1- 2-19	1,900	sd. sh. drilling
Clearwater Oil Co., No. 1 Bellflower, Los Angeles Co.	21- 3-12	1,450	sd. sh. drilling
Continental, No. 1 Alamitos, Los Angeles Co.	34- 4-12	4,450	hd. sd. drilling
Burlingham Pet. Co., No. 1 Compton, Los Angeles Co.	17- 3-13	2,204	cleaning out
Big Boy Drlg. Co., No. 1 Compton, Los Angeles Co.	22- 3-15	mtl.	building rig
Commonwealth Sec., No. 1 Compton, Los Angeles Co.	21- 3-13	1,360	sd. sh. drilling
Law & Law, No. 1 Watts, Los Angeles Co.	8- 3-13	mtl.	suspended
Hanners, George, No. 1 Watts, Los Angeles Co.	8- 3-13	3,655	sd. sh. drilling
Diller, W., No. 1 Watts, Los Angeles Co.	8- 3-17	Rig	suspended
Cal. Well Drlg. Co., No. 1 Compton, Los Angeles Co.	11- 4-13	5,500	recemented
Archer Oil Co., No. 1 Watson, Los Angeles Co.	17- 4-13	4,629	gr. sd. drilling
Harbor Oil Co., No. 1 Watson, Los Angeles Co.	17- 4-13	...	material
Russell Oil Co., No. 2 Joughin, Los Angeles Co.	23- 3-17	2,418	suspended
Pomona Oil Co., Well No. 1, Los Angeles Co.	32- 1- 8	1,220	cleaning out
Anchor Oil Co., No. 1 Puente, Los Angeles Co.	19- 2-10	4,820	suspended
Rucker, R. C., No. 1 Puente, Los Angeles Co.	27- 2-10	2,820	sd. sh. drilling
The State Co., No. 1 Puente, Los Angeles Co.	5- 2-10	2,648	hd. sd. drilling
Keck & Hall, No. 1 Puente, Los Angeles Co.	32- 2- 8	690	cemented
Urmi Oil Co., No. 1 Puente, Los Angeles Co.	31- 2- 8	1,511	suspended
Los Gatos Oil Co., No. 1 El Monte, Los Angeles Co.	16- 1-11	1,425	hd. sd. drilling
Union Oil Co., No. 1 Richfield, Los Angeles Co.	13- 3- 9	1,930	br. sh. drilling
Superior Oil Co., No. 1 Richfield, Los Angeles Co.	32- 3- 9	4,090	sd. sh. drilling
Coastline, No. 1 Devils Canyon, Los Angeles Co.	21- 5-17	2,085	gr. sd. drilling
Martin, J. W., No. 1 Newhall, Los Angeles Co.	22- 1- 7	788	gr. sd. drilling
Consolidated Oil Co., No. 1 Newhall, Los Angeles Co.	22- 3-16	450	hd. sd. drilling
Anderson, P. B., No. 1 Hasley Canyon, Los Angeles Co.	1- 3-16	688	cemented
Shell, No. 1 Bolsa, Orange Co.	18- 5-11	2,187	hd. sd. drilling
Shell, No. 1 Coyote, Orange Co.	28- 3-10	6,050	redrilling
Standard, No. 1 Coyote, Orange Co.	21- 3-10	1,230	sd. sh. drilling
Union, No. 1 Coyote, Orange Co.	30- 2-10	Rig	rigging up
Beard, G. F., No. 1 Brea Canyon, Orange Co.	30- 2- 9	1,199	br. sh. drilling
Western Gulf, No. 1 Brea Canyon, Orange Co.	28- 2- 9	...	grading
Mesa Pet., No. 1 Newport, Orange Co.	21- 6-10	3,914	recemented
Oil Well Eng. Co., No. 1 Newport, Orange Co.	21- 6-10	2,795	suspended
Oil Well Eng. Co., No. 2 Newport, Orange Co.	21- 6-10	mtl.	suspended
Hall Pet. Co., No. 1-A Murrietta, Riverside Co.	23- 7- 3	701	cemented
Hemet Pet. Co., No. 1 Ward, Riverside Co.	9- 5- 1	3,403	suspended
Imperial Valley Oil Co., Well No. 1, Imperial Co.	32-11-10	2,980	suspended
Turner, S. S., No. 1 Escondido, San Diego Co.	25-12- 2	3,005	sd. sh. drilling
McGregor Synd., No. 1 Del Mar, San Diego Co.	17-14- 3	1,066	sd. sh. drilling
Borderland Oil Co., No. 1 Encinitas, San Diego Co.	X-13- 4	1,095	sd. sh. drilling
China American Oil Co., No. 1 Oasis, San Bernardino Co.	17- 4- 4	mtl.	suspended
Grey, H. H., No. 1 Redlands, San Bernardino Co.	25- 1- 2	2,450	hd. sd. drilling
Duncan, N. I., No. 1 Mojave, San Bernardino Co.	8- 4- 6	Rig	rigging up

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Unusually Good Wells in Lima Field

Hancock County Makes Best Showing. Wood County Active. Good Completion in Sandusky Area. Tiffin Field Busy

By Whit
Staff Correspondent, Central West Fields

FINDLAY, Ohio, Dec. 2.—Unusually good producers were found in the late completions in the old Lima Field of northwestern Ohio, as well as some light wells and dry holes. Hancock County makes the best showing. In Liberty Township, L. Cramer's No. 4 on the John Shank farm, Section 32, produced an initial of 30 bbls. from the Trenton lime. This well is about 4 miles southwest of Findlay. In the northern part of Eagle Township, same county, and just south of the well on the Shanks farm, B. Porter and others' No. 30 on the J. H. Haley farm, Section 5, pumped 25 bbls. initial, with No. 31 under way. Star & Clark's No. 16 on the Alice Stauffer farm, Section 6, Eagle Township, produced 35 bbls. initial, with No. 17 drilling in the same section. J. M. Steen and others' No. 30 on the M. H. Deeds farm, produced 25 bbls. under pump in 24 hours, with No. 31 drilling. In Liberty Township, the Newton Oil Co. is drilling No. 16 on the A. Montgomery farm, Section 29, and N. and M. Harpst are drilling No. 9 on the W. H. Harpst farm, same section, and L. Cramer is drilling No. 5 John Shanks farm, Section 32. In Biglick Township, in the eastern part of Hancock County near the Seneca and Wyandot County lines, Robert Mitchell, trustee, is drilling a second test on the R. W. Moore farm, Section 21, about 8 miles east of Findlay, and the Ridge Gas & Oil Syndicate is drilling No. 4 Elenor Crow farm, Section 35, same township.

Wood County

In Wood County, Bloom Township, Mack Smith's test on the George Richards farm, Section 25, about 8 miles east of North Baltimore and between there and Fostoria, pumped 5 bbls. initial. Clark A. Browning is drilling No. 35 on the Frank McClare farm, Section 19, same township, between Cygnet and Gallatea, and near the big tank farm along the Ohio Central Railroad. In Lake Township, same county, between Toledo and Woodville, the Liny Airway Oil Co.'s No. 3, on the Simon Achenberger farm, pumped 5 bbls. the first 24 hours. Near Haskins, in Middleton Township, the Five Points Oil Co. is drilling No. 8 M. E. Bruce farm, Section 17. West of Portage, C. V. Darrow is drilling No. 6 on the F. W. Stratton farm, Section 10, Liberty Township, and has pulled out and abandoned old No. 1 on the same farm. In this township the Ohio Oil Co. abandoned No. 4 Thomas Carr farm; Nos. 1, 19 and 29, John Johnson farm; No. 23 S. H. Powell farm; No. 14 on the George and Royal Mercer farms, all in Section 11, and No. 6 on the William T. Reese farm, Section 9, Liberty Township, Wood County.

In Perry Township, Wood County, the Muncie Valley Oil & Gas Co. is drilling on the Mose Fletcher farm, Section 24, about 4 miles north of Fostoria. Glass & Shellenberger are drilling No. 3 on the Harry Brandeberry farm, Section 32, same township, about the same distance west of Fostoria. D. T. Earlton abandoned No. 1 on the J. W. Patton farm, same township. In Plain Township, same county, and west of Bowling Green, the Peninsula Oil Co. pulled out old No. 2 on the Homer C. Brown farm, Section 26. In the Prairie Depot Field, in Montgomery Township, north of Fostoria, also in Wood County, the Ohio Oil Co. abandoned Nos. 1, 3 and 4 Andrew Emerine farm, Section 17. Noonemaker and others abandoned Nos. 2, 3 and 4 on the Edwin R. Sage farm, Section 16, and Onsel Brothers abandoned Nos. 1, 2, 3, 4, 5 and 6 Barbara McSorley farm. Section 36, Montgomery Township.

Sandusky County Well

Another good well has been brought in near Lindsay, in Washington Township, Sandusky County, by the Gibsonburg Oil Co., in No. 5 on the Edith Fought farm, Section 11, with 35 bbls. initial. W. C. Richards and others' No. 9 on the A. E. Waggoner farm, same section, pumped 15 bbls. and the Lindy Oil Co. is drilling No. 1 Otto Fought farm, same section. In Madison Township, the Paul Oil Co. abandoned No. 1 Charles H. Paul farm, Section 15, and Smith & Rozelle did the same with No. 1 Etta Smith farm, Section 31. In Ballville Township, J. H. Murphy & Sons are drilling deeper No. 1 on the Isobal Sibrel farm, Section 31. It was formerly drilled to the gas sand and will go deeper in hope of finding oil.

Tiffin Field Active

The Tiffin Field of Seneca County remains quite active in a wildcat way. A new entrant, the Penn-Ohio Oil & Gas Co., of Pittsburgh, is drilling on the Peter Reinman farm, in Section 1, Hopewell Township, about 3 miles north of Tiffin in what is known as the Four Corners Pool, where four townships corner and all four have producing wells. This test of the Penn-Ohio company is in close proximity to the good oil well found by Ash & O'Neill on the James D. Watson farm, in the same section, which is reported around 175 bbls. a day and up, and by far the best producer in the Tiffin Field at this time. In Pleasants Township, same county, C. L. Messer and others' No. 1 on the C. E. Dennis farm, Section 30, northeast of the good Watson farm well, proved to be a duster. Hulse and others are drilling a second test on the Harry Beck farm, Section 30, same township, and George Huffman is drilling No. 1 Retta Noble farm, Section 18, Pleasants Township. H. Coyle's test on the Frank Beck farm, Section 24, Liberty Township, also developed into a dry hole. Geyer & Shaul are drilling No. 1 Ella Swander farm, Section 26, Clinton Township, 4 miles east of Tiffin. Mystic Oil Co. is drilling on the James Fish farm, Section 25, Reed Township, same county. A. B. Strouse and others are drilling on the John Stahl farm, Jackson Township, same county, a few miles northeast of Fostoria.

In Lucas County, John Doblinger is drilling a second test on the William G. Black farm, Section 17, Monclova Township, near Waterville and Monclova. Beaver Creek Oil Co. is drilling a purely wildcat test on the Elfa Pugh farm, Section 1, Richfield Township, Lucas County, close to the Ohio-Michigan State line in the vicinity of Richfield Center. East of Toledo, in Oregon Township, Lucas County, Fred Keister has abandoned his No. 1 on the Gertrude J. Niles farm, Section 19, along the south shore of Maumee Bay.

Crawford County

Indications are that the old Lima Field will be extended southward as much leasing is being done in Crawford and other counties. The test being made by the Local Oil Co. on the Catherine Walthers farm, Section 5, Liberty Township, is reported in the Trenton lime and making a deep test of it, having already reached close to 3,000 feet. The lease is reported to be owned by J. H. Williams of Pittsburgh, and is north of Bucyrus, near the town of Ridgeton. Oil has been found in the well at a reported depth of about 90 feet in the Trenton, but it is being drilled deeper to get as much information as possible of the local strata. Claud O. Fields of Kansas City, filed leases on 35 farms comprising around 3,000 acres in Sandusky, Jackson and Jefferson Townships, of Crawford County, the first test to be made near Crestline, in the eastern part of the county and almost directly east of Bucyrus, on the J. H. Cooper farm. Fields, according to report represents the firm of Teel & Friel.

The Ohio Oil Co. purchased the oil rights of J. H. Murphy & Sons of Burgoon, in the Tiffin Field of Seneca County. The consideration was not announced, but takes with it a nice production and a large leased acreage.

CENTRAL OHIO

Thirty-two completions were reported from the Central Ohio Field of which nine were producers with an initial production of 378 bbls., 9 dry holes and 14 gas wells. In new work starting there were 8 locations and 26 wells started spudding, a total of 34.

In Ashland County the Ohio Fuel Gas Co.'s No. 10-4,832 Anna Dalton farm, Section 3, Green Township, is a fairly nice gas producer. In Orange Township same company has a nice gasser in No. 2-4,877 Esther M. Irvin farm, Section 28, and started drilling No. 1-4,904 P. J. Hess, same section. Edmonds and others found a dry hole in a second test on the George Horn, Section 21, Lake Township, from 588 to 599 feet. The Kemrow Co. found a well with a good gas volume in No. 2 on the C. W. Hiner, Section 1, Montgomery Township, from 2,704-14 feet. Ohio Fuel Gas Co. started work at No. 1-4,947 Lola B. Smith farm, same section. Mohican Oil & Gas Co. is drilling No. 8 B. B. Chesrown, Section 3, Mohican Township.

In Medina County the Ohio Fuel Gas Co.'s No. 1-4,834 Sidney J. Cady, Section 4, Hinckley Township, was a dry hole. Same company is drilling No. 1-4,885 Frank L. Lyttle, Section 6, Brunswick Township. East Ohio Gas Co.'s No. 11 J. and A. Jalensics, Lot 10, Section 3, Chatham Township, was dry. The Kemrow Co. is drilling on the Frank Rhader, Section 4, Homer Township.

In Lorain County the Ohio Fuel Gas Co.'s No. 2-4,870 Julia Clark, Section 13, Carlisle Township, is an average gas well, and same company's No. 4-4,876, same farm and section, is drilling. Same company is drilling No. 1-4,928 John Koliha farm, Lots 46 and 47, Grafton Township.

Wayne County

In Wayne County, Chester Township, the Ohio Fuel Gas Co. struck an average gas producer in No. 1-4,887 Jane Myers farm, Section 18, and drilling No. 2-4,933 on the Mary Hagerman, Section 6, Congress Township.

In Holmes County, Richland Township, the East Ohio Gas Co.'s No. 1 on the C. S. Brown farm, Section 7, is reported to have produced 48 bbls. initial from 3,019-67 feet, and made a location for a second test on the Alonzo Bucy farm, Section 15. Same company made a location for No. 3 on the C. L. Sterling farm, Lot 27, Hardy Township, same county.

In Knox County the Ohio Fuel Gas Co. has started drilling No. 1-4,893 on the Charles S. Pealer farm, Section 25, Brown Township.

In Coshocton County, Pike Township, Spindler and others' No. 5 on the J. Wolford farm, Section 24, produced 15 bbls. initial from 2,996 to 3,029 feet, and the Hope Construction & Refining Co.'s second test on the Perry Ashcroft farm, Sections 4 and 7, same township, is a light gas well at from 3,175 to 3,225 feet.

Summitt County

In Summitt County, Franklin Township, F. A. Brendall and others' test on the Anna C. Bahney, Section 13, is above the average gasser from 3,986 to 4,001 feet. Stolz Oil & Gas Corp. is drilling on the F. B. Silk farm, same section. In Greene Township, the East Ohio Gas Co. has a fair gas well on the F. N. Steiner farm, Section 18, at from 3,555-63 feet. G. W. Crouse has what shows for only an average gas well in No. 4 on the Croude farm, Section 18.

In Licking County, Licking Township, the Heisey Gas Co.'s test on the John C. Sidle farm, Section 5, is reported good for 25 bbls. from 3,173 to 3,207 feet. Hope Construction & Refining Co.'s No. 4 Sarah Rector farm, Section 9, Perry Township, is reported good for 8 bbls. from the Berea sand from 679-91 feet. G. H. Long's No. 8 on the O. W. Dwiggins, Section 11, Mary Ann Township, is good for 2 bbls. from 770-78 feet. Emerald Petroleum Co. is drilling No. 2 Ira M. Cochran, Section 10, Fallsburg Township, and No. 2 on the Jacob Weiss farm, Section 8, same township. In Hanover Township the Everett Gas Co. is drilling No. 3 Felix Claypool farm, Section 7. Hope Construction & Refining Co. is drilling on the William H. Rickey farm, and staked a location for No. 5 on the Charles O. Bannon farm, Section 16.

In Muskingum County, Falls Township, the Athey Drilling Co. got a good gas well in a second test on the Edward D. Walker farm at from 3,605-39 feet, and a light gas well in No. 1, same farm, from 3,617-53 feet. The Preston Oil Co.'s No. 2,1,359 J. W. Varner, Section 5, Hopewell Township, reported good for 135 bbls. from 3,075 to 3,115 feet. This well also shows a fair gas volume. The Athey Co. is drilling on the Harry E. Elliott farm, Section 16, Rich Hill Township. Craig, Adair and others made a location on the Chester Cannon farm, Section 3, Clay Township. Dr. G. C. Taylor is drilling a second test on the Fred, Ella and Mary Smitley farm, Section 15, Perry Township.

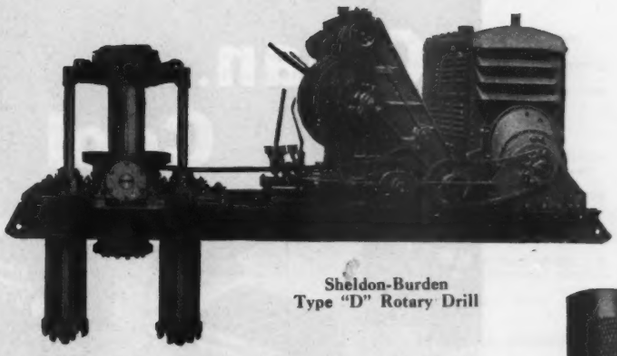
In Athens County, Ames Township, the Ohio Fuel Gas Co.'s No. 3 Albert Linscott farm, Section 3, is an average gas well from the second Berea sand from 1,590 to 1,608 feet; total depth 1,615 feet. Same company is drilling No. 4-4,858, same farm, and made locations for No. 2-4,952 F. J. Beasley, Section 3, and No. 3-4,953 Robert G. Brawley, fractional Section 12, same township. Orondorff and others are drilling No. 4 Linna Dean farm, Section 3. In Lee Township the Three Way Oil Co.'s second test on the S. C. Croos, Section 19, was a duster at 1,232 feet.

Meigs County

In Meigs County, Sutton Township, Tyree and others found a dry hole in No. 9 James E. Stobart farm, Section 12, at 580 feet. The Preston Oil Co. is drilling No. 4-1,393 on the Emma Williams farm, Section 24, and the Pure Oil Co.'s No. 6 W. J. Krider farm, same section, pumped 2 bbls. from the upper Berea sand from 1,788 to 1,806 feet, total depth 1,808 feet. Frick & Barnaby are drilling No. 9 Wesley Genheimer farm, Section 21, Chester Township. Ohio Fuel Gas Co. is drilling on the J. F. and Bessie Lee, Section 13, Scipo Township. H. F. McTaggart and others have a light gas well in No. 4 on the Frank Holliday farm, Section 18, Rutland Township, from 371-74 feet, total depth 384 feet. No. 5, same farm, is drilling.

In Jackson County, Franklin Town-

(Continued on Page 199)



Sheldon-Burden Type "D" Rotary Drill

Sheldon

Flush Joint Drill Pipe

Equipment *and*

Hydraulic Feed Rotary Tables

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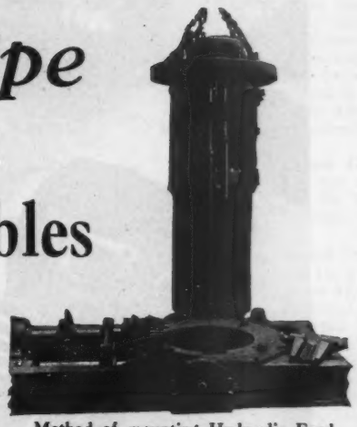

Method of mounting Hydraulic Feed Mechanism.

Table without Hydraulic Feed Mechanism ready to use regular kelly.

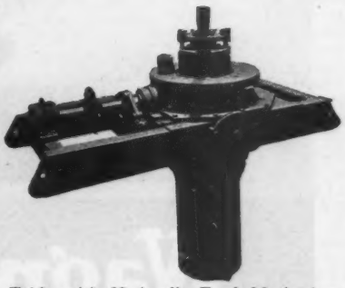

Table with Hydraulic Feed Mechanism and Flush Joint Pipe Drive Head. Kelly may be used with Hydraulic.

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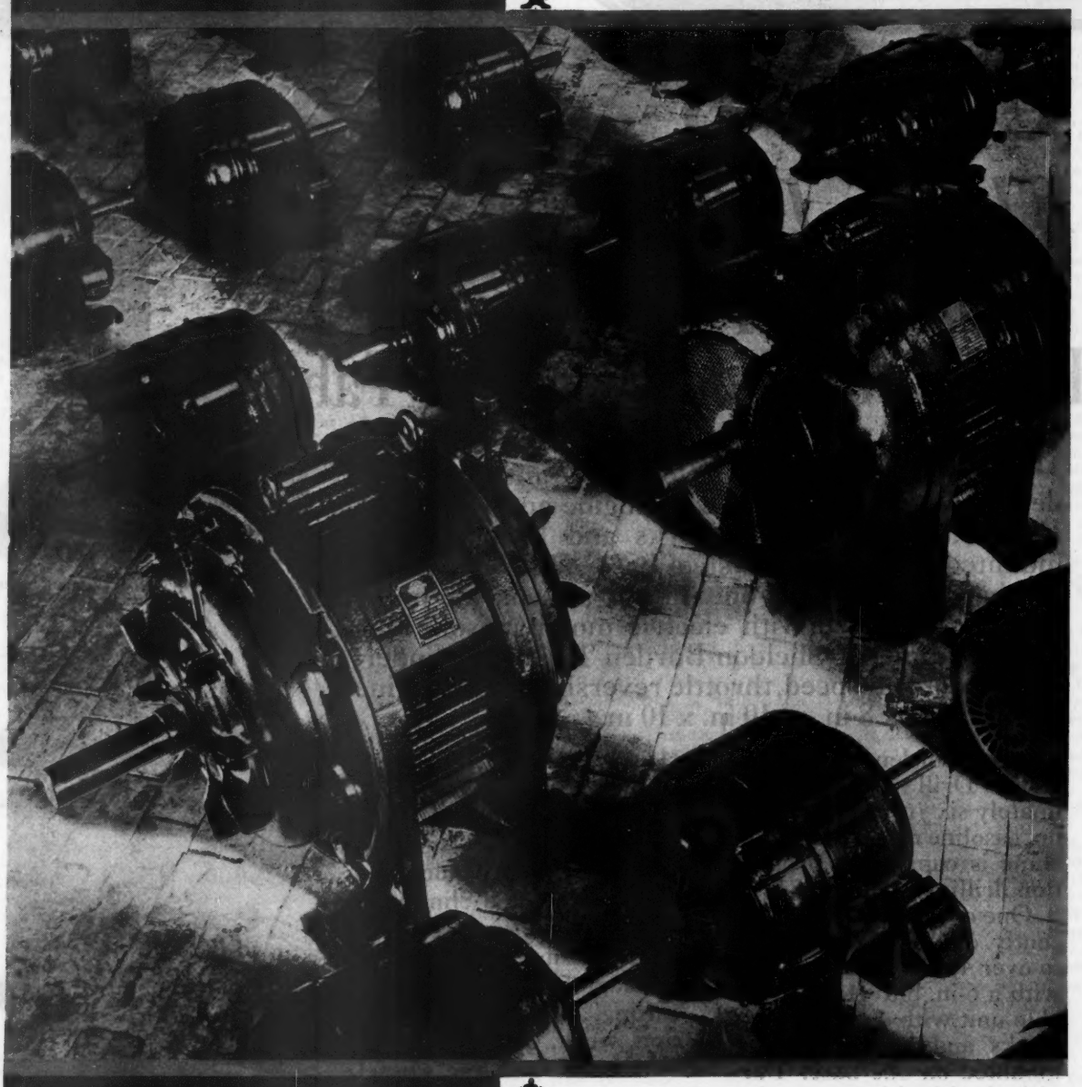

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Howard-Glasscock Area Extension

Glasscock Brothers Well Opens Large Territory to Westward That May Affect Curtailment. Gas Showing in Andrews County

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Dec. 2.—The high light of the Permian Basin during the week was the 3-mile western extension of the Howard-Glasscock County Pool towards World Oil Co.'s No. 1-C McDowell in Section 21, Block 34, 2-S, T.&P. Survey, which was completed about five months ago. Another showing of gas in Deep Rock Oil Co.'s No. 1 Ogden, Andrews County, also created more interest in that county.

The completion of Glasscock and others' No. 1 Edwards in Section 18, Block 33, T-2-S, T.&P. Survey, Glasscock County, the 3-mile extension well opens up a vast amount of new territory which might have a tendency to offset the first curtailment move. This new extension well is now shut down at 2,299 feet with preparations going on to put it on pump. The owners cored lime from 2,276-88 feet, encountering 4 feet of saturated lime, and when the well was first shut down at 2,288 feet it started filling up with oil. After swabbing it at 2,299 feet it was estimated good for about 400 bbls. on pump.

The Empire Gas & Fuel Co. drilled a dry hole in Section 9, one-half mile to the south of the above discovery, consequently the area looks balked on the south for production. The World Oil Co.'s No. 1-C McDowell, the discovery well of the World Pool in Section 21, Block 34, is 1½ miles southwest of the new discovery, but the intervening dry hole of Empire's precludes the connecting of the two producing areas although the pay is found at the same level.

The nearest production to the Glasscock Brothers' well, on the east, is in the Kirby Pool, Section 15, 3 miles distant. That pool was a 2-mile extension of the Settles Pool, and opened up considerable territory to production, just as this last discovery does. Wells in the Kirby Pool have been of such proportions, and activities were becoming so prevalent in this new area that operators and pipe line companies in this area began to feel the result of the completion of these wells. The last proration meeting was one outcome, and the cut in crude prices in these fields, another outcome, brought on by the extension's large wells choking storage and in dire need of outlets. The past prices also were adjudged rather high for the crude from that end of the field, and due to the drop in prices, it is believed the former situation will properly adjust itself in a short while and the Howard-Glasscock County area settle down to steady production and proper pipe line outlet for all leases.

Andrews County Gas Show

Deep Rock Oil Co.'s No. 1 Ogden in Section 6, Block A-46, Andrews County, came through with another show of gas this week, the show estimated between 1,000,000 and 2,000,000 feet. This was encountered from 4,165-75 feet. The test is now drilling at 4,235 feet in lime with the gas decreasing slightly. The first gas showing in this well was picked up around 2,925 feet, about 500,000 feet.

Cranfill & Reynolds' No. 1 Masterson, Section 104, Block 10, H.&G.N., Pecos County, which topped the pay about three weeks ago at 1,249-53 feet and encountered an increase from 1,268-69 feet has put 227½ bbls. of oil in storage since it started heading. Total depth is 1,445 feet. This is a rank wildcat and opens the surrounding territory to more testing, for the well is good for about 20 bbls. per day as it now stands. It is understood the owners are moving in a machine for an offset to commence drilling at once.

Big Lake Pool

The Big Lake Oil Co.'s No. 4-C University, Reagan County, the last deep test in the Big Lake Pool completed, is now increasing in daily production just as the first deep test in this pool did. The Big Lake well is now averaging better than 450 bbls. daily, whereas the previous weeks it was making only around 250 bbls; however, that was before the tools were fished out. The first deep test in this pool, Group No. 1's No. 1-B University, set another high mark this week when it produced 2,915 bbls. on November 26.

Shipley Pool

Shell Petroleum Corp.'s No. 1 Owens, the deep lime producer in the Shipley Pool, Ward County, in Section 16, Block 5, H.&T.C. Survey, is shut down after a fire burned the rig and engine house. This well drilled below the regular Shipley pay and encountered its deeper pay at 2,485 feet, an increase at 2,556-93 feet, and another at 2,909 feet. Total depth is 2,918 feet. It swabbed about 80 bbls. of oil before the rig burned, and now the company is rebuilding rig and repairing machinery to test the well. Since discovering this deeper pay, other companies have made offset locations to the Shell well, probably with intentions of drilling to the deeper pay and giving it a thorough testing. The well will be closely watched by companies holding offset acreage as soon as it is ready for testing, for striking this deeper pay gives the pool extra possibilities.

Pryor Area

In the Pryor or Courtney area, 9 miles west of Fort Stockton in Pecos County, the Phillips Petroleum Corp.'s No. 3 Pryor is shut down at 1,389 feet after topping the pay at 1,380 feet in sand. The hole filled 500 feet in the first eight hours and 600 feet the first 32 hours; 6⅝-inch casing was cemented at 1,360 feet and the well is now waiting on cement to set. Another week should give the status of this well as a commercial producer, if it is to make one, and as it now stands, it looks good for at least a small well. It is in Section 78, Block OW, and will be the second producer in this area. The company's No. 2 Pryor is the well which is now producing in this new sand pool. No. 1 was plugged after drilling past the sand pay.

Taylor County Line

Since no pipe line company has agreed to run a line to the Dunnigan and Shell Petroleum Corp.'s No. 1 David French, the discovery well in Taylor County, the owners have about decided to run a line from the pool, either to a point on the Texas & Pacific Railroad near Tye, or over to Cozart on the Santa Fe. The latter is abou 2½ miles distant, and the former about 4 miles. A loading rack will be erected and the oil shipped out by tank cars. The line will be probably a 3 or 4-inch. Nothing definite has been announced as to the line, but full information will no doubt soon be given out as to the owners' intentions and plans for a line.

WEST TEXAS PRODUCTION
Week ending November 30

County—	Wells	Prod.
Crane County	321	34,715
Crockett County	46	1,670
Ector County	4	120
Fisher County	7	1,475
Glasscock and Howard	442	39,310
Jones County	73	2,535
Loving County	16	820
Mitchell County	142	3,514
Pecos County	382	146,088
Reagan County	253	17,185
Runnels County	3	22
Scurry County	5	24
Upton County	244	9,900
Ward County	16	1,870
Winkler County	598	101,745
Total this week	2,552	359,993
Total last week	2,531	363,151
Increase	21	3,158

PIPE LINE RUNS
November 13 to November 20
Runs Through Trunk Lines

	Last period
Atlantic P. L. Co., Port Arthur, Tex.	37,009
Gulf P. L. Co., to coast via Ranger, Tex.	29,896
Humble P. L. Co., Comyn, Tex.	39,626
Humble P. L. Co., Ingleside, Tex.	49,319
Illinois P. L. Co., Del Rio, Tex.	47,570
Magnolia P. L. Co., De Leon, Tex.	10,752
Pasotex P. L. Co., El Paso, Tex.	7,307
Shell P. L. Co., Healdton, Okla.	41,605
Shell P. L. Co., Houston, Tex.	18,863
Texas Co., Houston, Tex.	33,984
Total	316,222

Tank Car Shipments

Reagan County Purchasing Co., McCamey	1,119
Thomas & Brann, Grant City	100
Orient Co., McCamey, Tex.	100
American Pet. Co., Pyote, Tex.	none
Southern Crude O. P. Co., Wickett, Tex.	11,837
Total	13,147

Runs to West Texas Refineries

Amarillo Production Co., Pyote, Tex.	Off
Bluebonnett Ref. Co., Wickett, Tex.	3,562
Burford Ref. Co., Pecos, Tex.	4,800
Col-Tex Ref. Co., Colorado, Tex.	7,500
Cosden Ref. Co., Big Spring, Tex.	8,674
Great Western Ref. Co., Big Spring, Tex.	3,609
Humble Oil & Ref. Co., McCamey, Tex.	none
Mid-Tex Ref. Co., Midland, Tex.	none
Tonkawa Ref. Co., Pyote, Tex.	2,135
Big Spring Ref. Co., Big Spring, Tex.	1,652
Richardson Ref. Co., Big Spring, Tex.	4,326
Wickett Ref. Co., Pyote, Tex.	227
Total	36,485

Summary

	Previous week	Last week
Pipe line runs through trunk lines	334,729	316,222
Tank car shipmen s	15,867	13,147
Runs to West Texas refineries	32,672	36,485
Total daily distribution	383,268	365,854
Total daily production	360,546	356,005
Daily average from storage	22,722	9849

WEST TEXAS COMPLETIONS
Week Ended November 30

Crane County

Simms and Atlantic Oil Producing Co.'s No. 2-F University, located in Section 45, Block 30, University Land, was shot with 100 quarts at 2,823-88 feet and with 150 quarts at 2,888-2,984 feet and had an initial production of 200 bbls. daily.

Glasscock County

Lion Oil Co.'s No. 2 Coffee, located Section 22, Block 33, Township 2s, had an initial production of 500 bbls. at 2,153-2,235 feet.

Howard County

Continental Oil Co.'s No. 5 Kloh-Rumsey, located Section 13, Block 33, Township 2s, had an initial production of 40 bbls. hourly at 2,157 feet. Group One and Continental Oil Co.'s No. 7-A Settles, located Section 135, Block 29, W.&N.W. R.R. Survey, had an initial production of 70 bbls. at 2,948-2,959 feet. Pure Oil Co.'s No. 2 Hooks, located Section 140, Block 29, W.&N.W.R.R. Survey, topped the pay at 1,844 feet, was drilled to a total depth of 1,855 feet and had an initial production of 50 bbls. California Co.'s No. 8 Roberts pumped 200 bbls. in 24 hours at 2,956-90 feet.

Pecos County

Cowboy Evans' No. 1 Pecos Valley Oil Co. topped the pay at 1,556 feet, was drilled to a total depth of 1,604 feet and had an initial production of 6 bbls. daily. Landreth Production Corp.'s No. 3-A University, topped the pay at 1,657 feet, was drilled to a total depth of 1,684 feet, had an initial production of 562 bbls. first 24 hours. Landreth's No. 1-C University was completed November 23 at 1,010 feet, topped pay at 945 feet and had an initial production of 30 bbls. daily. This well was deepened to 1,040 feet and is now pumping 32 bbls. daily. Landreth and World Oil Co.'s No. 5-B University had an initial production of 1,432 bbls. in 24 hours at 1,609-56 feet. Mid-Kansas and Transcontinental Oil Co.'s No. 19 Smith-Taylor had an initial production of 171 bbls. at 1,640-1,735 feet. Pecos County Crude Oil Purchasing Co.'s No. 3 Pecos Valley Oil Co. had an initial production of 7 bbls. daily at 1,610-1,952 feet. Shell Petroleum Co.'s No. 2-C University had an initial production of 165 bbls. at 1,639-56 feet. Its No. 3-C University had an initial production of 765 bbls. at 1,592-1,645 feet. Taylor-Link Oil Co.'s No. 5 University topped the pay at 1,585 feet, was drilled to a total depth of 1,644 feet and had an initial production of 270 bbls. at 1,595-1,639 feet. California Co.'s No. 3 Smith topped the pay at 1,815 feet, was drilled to a total depth of 1,832 feet and had an initial production of 25 bbls. Moncrief's No. 1 Clarkson was dry and abandoned at 1,832 feet.

Ward County

Atlantic and Delmar's No. 4 Hayzlett, located assuming common line Sections

(Continued on Page 226)

WILDCAT OPERATIONS IN WEST TEXAS

Week Ended December 2

ANDREWS COUNTY

Company, farm and location—	Remarks—
Deep Rock's No. 1 Ogden, 2,310 ft. E. 330 ft. S. Sec. 6, Blk. A-46, Public School Land	Gas show 2,895-2,900 ft.; show oil 2,900-10 ft.; 2,000,000 ft. gas 2,910-25 ft.; top lime 4,050 ft.; drlg. 4,125 ft.

BORDEN COUNTY

Monerief et al's No. 1 Munger, C of SW. Sec. 14, Blk. 31	Shut down 2,425 ft.
Texas & Wheeler's No. 1 Long, 1,320 ft. N and E of Sec. 27, Blk. 30, T.&P. Sur.	Top salt 1,030 ft.; shut down 3,850 ft.

BREWSTER COUNTY

E. W. Bateman et al's No. 2 Nevill, 2,000 ft. S and W line of Sec. 62, Blk. 13, G.H.&S.A.R.R. Sur.	Shut down 2,274 ft.; fishing.
Brewster Oil Co.'s No. 1 fee, 2,640 ft. S and 2,598 ft. E of NW cor., Sec. 45, Blk. G-15, G.C.&S.F.	Fishing 1,935 ft.
Cowden & Bowser's No. 1-A Jackson & Harmon, Sec. 1, Blk. 331, T.C.R.R. Sur.	Set 8-in. 1,550 ft.; shut down 2,000 ft.
Forrest Oil Co.'s No. 1 Skinner, C SW SE, Sec. 100, Blk. 2, G.C.&S.F. Sur.	Shut down 830 ft.
Grastorf et al's No. 1 Redfield, 920 ft. from N and 2,500 ft. from E of Sec. 18, Blk. G-15, G.C.&S.F.R.R. Sur.	Building Rig
J. M. Hickey's No. 1 Jackson & Harmon, NE cor., Sec. 182, Blk. 9, G.H.&S.A. Sur.	Shut down 1,302 ft.
Van McPhail's No. 1 McIntyre, SE cor. Sec. 59, Blk. 353, 7 mi. S of Alpine	Shut down 1,740 ft.

(Continued on Page 192)

Bulcher Pool Extension Uncertain

Tarver County Test May Be Small Producer. Baylor County Semiwildcat Estimated 40 Bbls. Gray County Off

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Dec. 2.—The Panhandle and Wichita Falls districts were rather quiet this week, and developments will probably be hampered somewhat during the next two months due to winter weather and pipe line facilities in the Panhandle district running to their capacities. Gray County fell off 2,235 bbls. daily average this week from 64,305 bbls. to 62,070 bbls. while Hutchinson County picked up 500 bbls. more per day, Carson County also increasing almost 400 bbls. daily; however, Moore County fell off slightly, as did Potter.

Ray Rathford's No. 1 J. C. Jones, 1,850 feet from the north and 150 feet from the west lines of the J. J. Arocha Survey, 1½ miles west of the Bulcher Pool in Cooke County, had a show of oil and water from sand found from 1,594-1,604 feet, last week, and the well is now shut down at 1,617 feet with no further showings or increase. This test looked as if it might extend the Bulcher Pool and open up considerable more territory to production, but as the well now appears in an uncertain stage it will be another week before anything definite can be told about it.

Tarver Pool Test

Shell Petroleum Corp. and Fain & McGaha's No. 1 French, in the Tarver Pool, Foard County, was given a 40-quart shot this week which seemed to help it materially for it swabbed 44 bbls. after the shot, and looks as if it might come through for a small producer although the owners have been spending several weeks with it trying to nurse it up to a producing status. It is now cleaning out at 2,037 feet, and the next week will no doubt tell for sure just what is to become of it. If this week's work does not pull it into the producing class it may be abandoned.

Sheldon and Jamison's No. 1 Volkart, the semiwildcat discovered in Wichita County, Section 309, which encountered oil sand from 1,915-25 feet, November 2, and opened up more territory in this county, flowed 225 bbls. in 24 hours after fishing out the tools which have been stuck in the hole since the well first started showing oil. Total depth of the well is 1,930 feet. The Prairie Oil & Gas Co. is taking the oil which is 39 gravity.

Baylor County Well

Grisham and Barnsdall Oil Corp.'s No. 1 Portwood in Section 1,281, T.E.&L. Survey, Baylor County, in semiwildcat territory, is now being put on the pump at total depth of 1,402 feet. It encountered its first oil show from 1,375-76 feet, another from 1,388-98 feet and another from 1,398-1,402 feet. It flowed 15 bbls. while cleaning out. This well is in the southwestern extension to the Megargle Pool. Consolidated Oil Co.'s No. 2 Portwood in this extension is cleaning out at 1,423½ feet after encountering oil showings from 1,393-1,413 feet and 1,413-23½ feet. It is estimated good for 40 bbls. daily.

In Brown County the Darby Petroleum Corp. completed its No. 4 Belvin for a 169-bbl. well. It is in the NW cor. of the 40-acre Belvin lease in the SE cor. of Section 42, H.T.&B. Survey. It extends the George Pool in a northeast direction along the same trend as the Smith-Ellis and Fry Pools.

Cross Cut Field

S. C. Herring was reported to have purchased the Cross Cut Oil Corp.'s holdings in the Cross Cut Field, the J. W. Newton and John Keller leases in the Robert Mitchell Survey No. 141. There is no production on the Newton lease, but there are eight wells averaging 13 bbls. per day on the Keller lease. Consideration was named as $12,000.

Gutzman and Aldrich completed No. 1 Haas, 9 miles south of Coleman, for a 7,000,000-foot gasser. It is 1,000 feet southeast of the Haas oil pool in Section 71, G.H.&H. Survey. The gas sand, which is the same as the Haas production, was encountered at 1,489 feet and was drilled 9 feet in. The Oklahoma Natural Gas Co. made connections to the well.

Production in the Eastland Pool in Coleman County is now averaging better than 3,600 bbls. per day.

The Lloyd Oil Corp. completed No. 1 Bartholomew in the William Farris Survey for an initial production of 150 bbls. per day. This is in the area opened up by Joines' No. 1 Richardson in Section 96, E.T.R.R. Survey, Coleman County, some time ago. The Joines well and the Lloyd well are producing from the Brenecke sand, the latter well from pay found from 1,426-44 feet. No. 2 drilled by Joines on his lease was a dry hole, missing the Brenecke sand.

WICHITA DISTRICT COMPLETIONS
Week ending November 30

Cooke County

Kewanee Oil & Gas Co.'s No. 2 Coker was dry and abandoned at 1,600 feet.

Archer County

J. C. Haynes' No. 1 Hemmie was dry and abandoned at 1,350 feet. F. Hutcheson's No. 2 Hutcheson was dry and abandoned at 1,427 feet. United Producers Co. and Perkins & Cullum's No. 1 Lyles was dry and abandoned at 1,731 feet. Consolidated Oil Co. and Hill's No. 1 Neal was dry and abandoned at 1,101 feet.

Jack County

L. C. Harper's No. 7 Box had an initial production of 145 bbls. at 3,126-32 feet. His No. 8 Box had an initial production of 115 bbls. at 3,128-48 feet. Llewellyn & Knight's No. 2 Loving was dry and abandoned at 4,400 feet. Panhandle Oil & Refining Co.'s No. 2 Eaton and others had an initial production of 265 bbls. at 3,110-15 feet. Its No. 1 McKelvey had an initial production of 448 bbls. at 3,095-3,105 feet.

Young County

Riggs & Williams' No. 2 Vanmeter was dry and abandoned at 1,065 feet. Wise & Porterfield's No. 3 Cullers had an initial production of 25 bbls. at 553-78 feet. Wooten & Reed's No. 2 Casey was dry and abandoned at 616 feet. Atlantic Oil Producing Co.'s No. 1 Jarnigan was dry and abandoned at 3,890 feet. Shaw and others' No. 1 McLaren had an initial production of 49 bbls. at 2,594-2,617 feet. Shaw and others' No. 1 Roark was dry and abandoned at 4,230 feet.

Wilbarger County

Consolidated Oil Co.'s No. 1 Dill was dry and abandoned at a total depth of 2,350 feet. Fain & McGaha's No. 15 Waggoner had an initial production of 125 bbls. at 2,274-94 feet. Their No. 21 Waggoner had an initial production of 84 bbls. at 2,281-2,311 feet. Shaw Oil Co.'s No. 7 Waggoner had an initial production of 60 bbls. at 2,406-28 feet. The Texas Company's No. 367 Waggoner was dry and abandoned at 1,132 feet.

Wichita County

Culbertson's No. 64 Waggoner was dry and abandoned at 1,624 feet. American Refining Co.'s No. 1 Morgan-Couper had an initial production of 20 bbls. at 1,570-75 feet. Culbertson Co.'s No. 63 Waggoner Brothers had an initial production of 5 bbls. at 372-391 feet. Hobbs' No. 1 Munger had an initial production of 140 bbls. at 1,758-62½ feet. Hunter's No. 10-C Waggoner Brothers was dry and abandoned at 1,501 feet. Sheldon & Jamison's No. 1 Volkart had an initial production of 225 bbls. at 1,915-30 feet. Stump and others' No. 2 Waggoner was dry and abandoned at 1,847 feet.

PANHANDLE COMPLETIONS
Week ending November 30

Gray County

Humble Oil & Refining Co.'s No. 1-A Chapman, located 330 feet from north and east of NW Section 69, Block 25, H.&G.N.R.R. Survey, was drilled to a total depth of 2,990 feet, was plugged back to 2,808 feet, made 7,000,000 feet of gas at 2,666-2,808 feet. The Texas Company's No. 3-B Chapman, located 330 feet south and east of NW SE, Section 69, Block 25, H.&G.N.R.R. Survey, had an initial production of 412 bbls. oil and 10,000 feet of gas at 2,655-2,700 feet. Magnolia Petroleum Co.'s No. 8 Bowers, located Section 63, Block B-2, H.&G.N.R.R. Survey, had an initial production of 775 bbls. at 2,990-3,003 feet.

Hutchinson County

Continental Oil Co.'s No. 1-B Johnson Brothers, located 330 feet south and west of NE NW, Section 6, Block 1, B.&B. Survey, was drilled to a total depth of 3,178 feet, topped the pay at 3,173 feet and had an initial production of 2,850 bbls. oil and 85 bbls. water. Phillips Petroleum Corp.'s No. 6 Johnson Brothers (Florence) topped the pay at 2,875 feet, was shot with 54 quarts at 2,788-2,828 feet, drilled to a total depth of 2,926 feet and had an initial production of 45 bbls.

NORTH TEXAS PRODUCTION
Week Ending November 30

Panhandle district—	Bbls.
Carson County	10,035
Hutchinson County	27,510
Gray County	62,070
Moore County	680
Potter County	0
Wheeler County	790
Total this week	101,085
Total last week	102,539
Decrease	1,454
Wichita district—	
Archer County	18,570
Baylor County	65
Clay County	830
Cooke County	8,505
Foard County	215
Jack County	3,850
Haskell County	115
Montague County	6,375
Throckmorton County	605
Wilbarger County	25,205
Young County	7,345
Wichita County	30,870
Total this week	102,550
Total last week	101,688
Increase	862
Ranger district—	
Brown County	10,495
Callahan County	3,400
Coleman County	6,370
Comanche County	1,245
Palo Pinto County	540
Eastland County	5,300
Shackelford County	9,465
Stephens County	6,315
Total this week	43,130
Total last week	43,306
Decrease	176
Grand total this week	246,765
Grand total last week	247,533
Decrease	768

(Continued on Page 219)

WILDCAT OPERATIONS IN TEXAS PANHANDLE

Week Ending December 2

CARSON COUNTY

Company, well, farm, name, section and block— Remarks—

Continental Oil Co.'s No. 2 Block, 990 ft. from N, 330 ft. from E, SE, Sec. 111, Blk. 4, I.&G.N.R.R. Sur. ... Drlg. 445 ft.

Danciger O. & R. Co.'s No. 1 Block, 330 ft. from N and E lines, Sec. 112, Blk. 4, I.&G.N. Sur. ... S.D. 2,851 ft.

Delmar Oil Co.'s No. 5 Noel, 330 ft. S and W, NE cor. W½ SE, Sec. 198, Blk. 3, I.&G.N. Sur. ... S.G. 3,000-10 ft; S.D. 3,131 ft.

Empire G. & F. Co.'s No. 1 Fields, 1,650 ft. from N and E, Sec. 13, Blk. 7, I.&G.N. Sur. ... Shut down.

Empire G. & F. Co.'s No. 2 Deahl, 660 ft. N and E, SW, Sec. 3, Blk. 5, B.&B. Sur. ... Drlg. 2,333 ft.

Empire G. & F. Co.'s No. 1 Thorp, C NW, Sec. 26, Blk. T, A.B.&M. Sur. ... Building rig.

Ham Oil Co.'s No. 1 Cooper, 330 ft. from S and W, E½ NE, Sec. 5, Blk. 9, H.&G.N.R.R. Sur. ... Drlg. 807 ft.

Herragan Oil Co.'s No. 1-A McConnell, 330 ft. from N and W, W½ SW, Sec. 137, Blk. 3, I.&G.N.R.R. Sur. ... Drlg. 900 ft.

S. D. McElroy's No. 1 Block, 330 ft. from N and E, NE NW, Sec. 113, Blk. 4, I.&G.N.R.R. Sur. ... Drlg. 1,345 ft.

McMan O. & G. Co.'s No. 1 McConnell, 330 ft. from N and E, E½ SW, Sec. 137, Blk. 3, I.&G.N.R.R. Sur. ... Drlg. 1,500 ft.

Osborne et als' No. 3 Percival, 330 ft. N and W, SE cor. E½ NE, Sec. 199, Blk. 3, I.&G.N.R.R. Sur. ... Location.

Pansota Oil Co.'s No. 1 Block, 330 ft. S and W, NE cor. SW, Sec. 111, Blk. 4, I.&G.N.R.R. Sur. ... Rig.

Phillips Pet. Co.'s No. 1 Garner, 330 ft. N and E, SW cor. SW, Sec. 114, Blk. 4, I.&G.N. Sur. ... Fishing 2,940 ft.

Prairie O. & G. Co.'s No. 2 Nail, 330 ft. from N and W lines, N½ E½ SE, Sec. 198, Blk. 3, I.&G.N. Sur. ... 10,000,000 ft. gas 2,836-2,985 ft; S.D. 3,112 ft.

Red River Gas Co.'s No. 2 Lee Bivins-A, C SE SE, Sec. 43, Blk. M-20, G.&M.R.R. Sur. ... S.D. 550 ft.

Ryan Cons. Oil Co.'s No. 7 Block, 330 ft. N, 990 ft. W, SE cor. NE, Sec. 111, Blk. 4, I.&G.N.R.R. Sur. ... Location.

Shell Pet. Corp.'s No. 1 Percival, 330 ft. from N and E, SE, Sec. 199, Blk. 3, I.&G.N. Sur. ... Rig.

Skelly Oil Co.'s No. 19 Schafer, 330 ft. N, 990 ft. E, SW cor. NE, Sec. 198, Blk. 3, I.&G.N. Sur. ... 6,000,000 ft. gas 2,395-2,970 ft; S.D. 3,100 ft.

Skelly Oil Co.'s No. 20 Schafer, 330 ft. N, 990 ft. W, SE cor. N½, Sec. 198, Blk. 3, I.&G.N. Sur. ... S.D. 3,090 ft.

Skelly Oil Co.'s No. 21 Schafer, 340 ft. N, 1,540 ft. W, SE cor. SE, Sec. 68, Blk. 4, I.&G.N.R.R. Sur. ... Location.

Stubblefield et als' No. 1 Garner, 330 ft. from S and E lines, SE, Sec. 104, Blk. 4 ... T.P. 2,990-3,024 ft; I.P. 35 bbls; T.D. 3,095 ft; P.B. 2,800 ft.

The Texas Co.'s No. 3 Noel, 330 ft. N and W, SE cor. NW, Sec. 137, Blk. 3, I.&G.N.R.R. Sur. ... Rigging up.

The Texas Co.'s No. 3 Quinn, 330 ft. N, 990 ft. E, SW cor. E½, Sec. 7, Blk. 9, I.&G.N.R.R. Sur. ... Drlg. 270 ft.

CASTRO COUNTY

Colorado O. & R. Co.'s No. 1 M. Slemmons, SW cor., Sec. 73, Blk. M-17, B.S.&F. Sur. ... Rig blown down.

Mystery Oil Co.'s No. 1 J. I. Crum, SE cor. NE, Sec. 333, Blk. M-6, S.K.&K. Sur. ... S.D. 510 ft. for csg.

CHILDRESS COUNTY

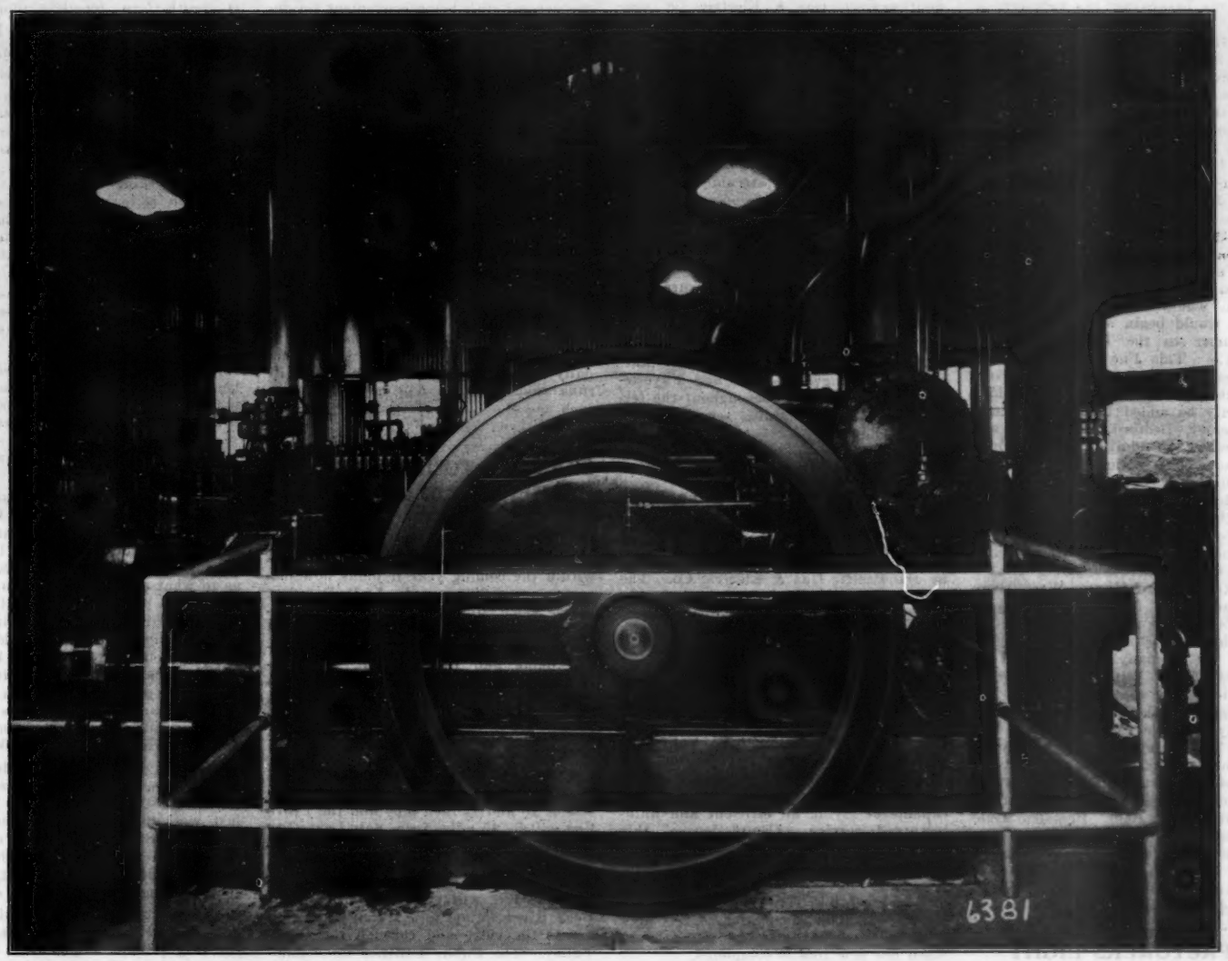
C. L. Sloane et als' No. 1 B. P. Smith, Sur. 49, F. P. Knott lands ... S.D. 4,675 ft.

COCHRAN COUNTY

Westbrook et als' No. 1 Slaughter, 400 ft. from S and E, Labour 67, League 118, Knox Co. School lands ... Set 8-in. csg. 2,771 ft.

(Continued on Page 92)

COMPLETE ENGINEERING *and* TURN-KEY CONSTRUCTING



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Tulsa, Oklahoma

Pipe Line Construction News

INDIANA CONSUMERS CO. EXTENDING ITS SYSTEM

Keeping pace with the recent development in the by-product gas industry, A. M. Ogle, president of the Indiana Consumers Gas & By-Products Co., announced the completion of another link in the high pressure gas transmission system of the company. The gas supplied by the Central Illinois Public Service Co. in Paris, Kans., Charleston and Mattoon, Ill., will be delivered from the Indiana Consumers Gas & By-Products Co.'s plant at Terre Haute, Ind. Shortly after January 1 it is planned to extend this service to include Pana, Taylorville, Shelbyville and Effingham, Ill.

President Ogle also reported that the company's new lines to the East, which have been under construction since September 1, would be completed and his company would begin serving gas about in December to the Interstate Public Service Co. This line will supply the requirements of Martinsville, Greencastle, Bloomington and Franklin, Ind., to which will shortly be added Edinburg, Columbus, Seymour, Bedford, Greenwood and Beech Grove. In addition a new 6-inch line is under construction by the Indiana Gas Utilities Co. (part of the Associated Gas & Electric system) to serve Clinton, Ind., with gas produced at the Terre Haute by-products plant.

The Indiana Consumers Gas & By-Products Co. has been supplying the requirements of Terre Haute, West Terre Haute and Brazil for many years producing 750,000,000 feet of gas per year.

The addition to the pipe line system increases the company's annual load by 150,000,000 feet. With the completion of extensions now contemplated and under construction, the Indiana Consumers Gas & By-Products Co. will supply gas from its Terre Haute plant to a territory extending from the center of Illinois to the eastern part of Indiana, increasing its yearly sendout to a total of 1,600,000,000 feet in 1930. President Ogle stated that in line with the most recent developments his company was equipping its plant to furnish gas for long distance transmission at pressures up to 350 pounds per square inch.

MANUFACTURERS LIGHT BUYS SOUTHERN LINE

NEW YORK, Dec. 2.—The Southern Pipe Line Co. announces that arrangements have been completed for the sale of another of its lines to the Manufacturers Light & Heat Co. for $506,391.

This will leave the company only one line, which its officers says is sufficient to handle more than twice the volume of oil which probably will be offered it.

If the proposed sale is approved. the company will distribute to stockholders $5 a share from the capital stock reduction account.

SAGINAW-SPRINGFIELD LINE

Construction of the Empire companies' 10-inch natural gas pipe line from Saginaw to Springfield, Mo., is about three-fourths complete. This line, 65 miles long, will supply natural gas to Springfield for domestic and industrial uses.

In connection with this project, about 23 miles of 2 to 4-inch pipe lines are being laid to serve towns adjacent to the 10-inch line. They are: Pierce City, Monett, Aurora, Marionville, Billings and Republic, Mo.

Border meter stations are being installed at these towns, and natural gas service in the new area is expected to start about December 18.

SOUTHWESTERN GAS CO. IN EXPANSION PROGRAM

SHREVEPORT, La., Dec. 2.—The Southwestern Gas & Electric Co. contemplates spending more than $4,000,000 in new construction during the next year, according to announcement by A. Lieberman, president. The expenditure will be in improving the service of the company in 140 towns and cities it serves in Louisiana, Texas, Arkansas and Mississippi, exclusive of all maintenance costs.

The program provides for expansion and improvement of stream generating stations, installation of more substation capacity, transmission lines, $2,858,000; office buildings, gas distribution systems, street railway and ice plant improvements, approximately a half million dollars miscellaneous extensions, rural and otherwise, and real estate purchases, $650,000.

The construction program includes projects in Shreveport, Texarkana, Marshall and Longview, Tex., and Fayetteville, Ark., as well as throughout the territory in the four states served by the Southwestern.

NATURAL GAS SYSTEM WILL COST $12,000,000

Details of a $35,000,000 construction program for 1930 have been made public by the Pacific Gas & Electric Co. The largest items in this program are $12,000,000, which will be devoted to complete the natural gas pipe line system from the Kettleman Hills Fields to the San Francisco Bay region and $16,000,000, which will be spent on the Mokelumne River hydroelectric project.

The second network of pipe lines from Kettleman Hills to northern California will be finished early next spring and will be linked up with the present system, thereby affording a complete system capable of giving an efficient and uninterrupted service. Completion of this line will give the company more than 750 miles of natural gas pipe lines, representing a total investment of $27,500,000 and serving 470,000 of its 485,000 consumers. The San Francisco Bay area will be furnished straight natural gas when the new line is completed.

Apart from the natural gas project, the company will spend $3,000,000 on additions to its present gas system.

ALBERTA PIPE LINE COMPLETED

CHATHAM, Ontario, Nov. 30.—The Alberta Pipe Line Co. has completed a new 28-mile oil line from the Turner Valley Field to the Regal Oil Refineries' plant at Calgary. Following a successful test run, the line is reported in full operation. It has a capacity of 6,000 bbls. a day, considerably more than the present production of the entire field; but is built with a view to future developments. The line will handle the production of a number of independent companies delivering crude oil and naphtha to the Regal plant. It connects with existing lines linking the central and northern portions of the field, but a survey is now being made for a possible extension to the South Turner Valley, and extensions are planned to the Waite Valley and Highwood structures should these develop commercial production.

LINE TO MUSKOGEE

The Oklahoma Natural Gas Corp. is laying an 8-inch line from Section 35-11-9 to Section 31-11-11. It will take gas from the new pool in Section 31-11-11 to Muskogee for domestic purposes.

LAYING PARALLEL LINE BIG LAKE TO KEMPER

FORT WORTH, Tex., Dec. 2.—Due to the present time being convenient for the Reagan County Purchasing Co. to lay a 6-inch line from the Big Lake Pool to its tank farm at Kemper in Reagan County, construction of such a line paralleling its present 8-inch line is under way. This new line is being laid in a replacement program to take over the transportation of crude oil from the Big Lake Pool to the tank farm. The daily average runs now are about 17,000 bbls.

Sections of the old 8-inch line have been replaced in several places and due to corrosion eating up the present line it is felt that a new line might be needed at any time. Corrosion takes place more slowly under a high pressure in a full line therefore the 6-inch will probably be more economical than an 8-inch, the 6-inch being able to handle the present daily runs. It is also felt that the daily runs from the pool will not increase to such an amount that the 6-inch cannot handle them.

GAS LINE TO IDAHO WILL BE 200 MILES LONG

DENVER, Colo., Dec. 2.—Idaho will have natural gas for some of its cities within the coming year if plans now maturing are consummated. L. B. Denning, of the Lone Star Gas Co., and John McFadyen, vice president of the Ohio Oil Co., have applied to the cities of Pocatello, Idaho, and Provo, Utah, for franchises. Both men are connected with the Western Public Service Co. which this year completed a natural gas system connecting Wyoming and Colorado gas fields with cities and towns in central Utah.

The line from Ogden to Pocatello will be about 200 miles long and will consist of 10 and 12-inch pipe and the Provo line will be 45 miles from Salt Lake City and will consist of 12¾-inch pipe. Surveying parties for the Idaho extension are now in the field and it is probable that the line will either go through the Bear River Canon and Malad Valley, or across the ridge and through the Cache Valley. The Public Utilities Consolidated Corp. now serves Pocatello with manufactured gas, but it is stated that no arrangements have been made for taking over that company.

Judge George W. Edington, president of the Grand Teton Oil Co., which is drilling a test well on the Horseshoe structure, 40 miles from Pocatello, has filed a protest against the granting of franchises with the Public Utilities Commission to bring gas into the state from the outside while a local field may supply all that is needed. He asks a delay in acting upon the applications and he will appear before the commission at Boise on December 12.

SAGINAW COMPRESSOR STATION

The Saginaw, Mo., compressor station, 2 miles east and 4 miles south of Joplin, Mo., now is ready for service. Construction was started in September. The pumping equipment was tested in October. The station will be used in supplying natural gas service to Pierce City, Marionville, Monett, Republic, Billings, Neosho and Springfield, Mo.

The station equipment consists of two 180-horsepower new type 80 Cooper-Bessemer gas engines, with the necessary auxiliary equipment, all of which is of the latest and most improved design.

SPECIAL PIPE ORDERED FOR CALIFORNIA LINE

PITTSBURGH, Pa., Dec. 2.—The A. O. Smith Corp., formally announces having booked an order from the Pacific Gas & Electric Co. of California, for 123 miles of 26-inch line pipe, with "Smith-weld" steel expansion joints of equal diameter, the total weight being approximately 63,000 net tons. This is a larger size than Smith has hitherto made and the regular pipe mills do not make it as a regular thing in quantity if at all. Shipment is to begin within a fortnight, the line to be laid in California over rugged country, which accounts for the use of the special joint, making the formation of bends practically a shop job.

The pipe mills have some line pipe business, but not a great deal. Orders lately have been for small lots but fairly numerous.

Demand for standard or merchant pipe has been tapering off seasonally, but it is fully as heavy as would be expected for the time of year, if not heavier. The year to date makes a fair comparison with last year, there being no material difference either way.

Some observers put the rate of operation of the pipe industry at 60 per cent and there are suggestions that some producers are running even a little better than that, but there is basis for doubt as to what capacity is used to divide into the actual production to get the percentage. Apparently the capacity used is considerably below what would have been taken a couple of years ago in figuring, the explanation being that trade conditions and prospects are such that some capacity active a few years ago will never again be employed. Seamless tube mills are running at barely 60 per cent.

The sum total of steel production slips a litle from week to week, say a couple per cent a week in the last two weeks, last week's steel ingot production being probably 68 or 69 per cent of total reported capacity. The high point was last May, practically 100 per cent, while October averaged about 85 per cent.

Current buying of steel mill products is at a fair rate, being substantially all for very prompt shipment as buyers are conservative. The general tone of the market seems to be better than a fortnight ago. Fears are dying out of any serious consequences to follow promptly the stock market crash.

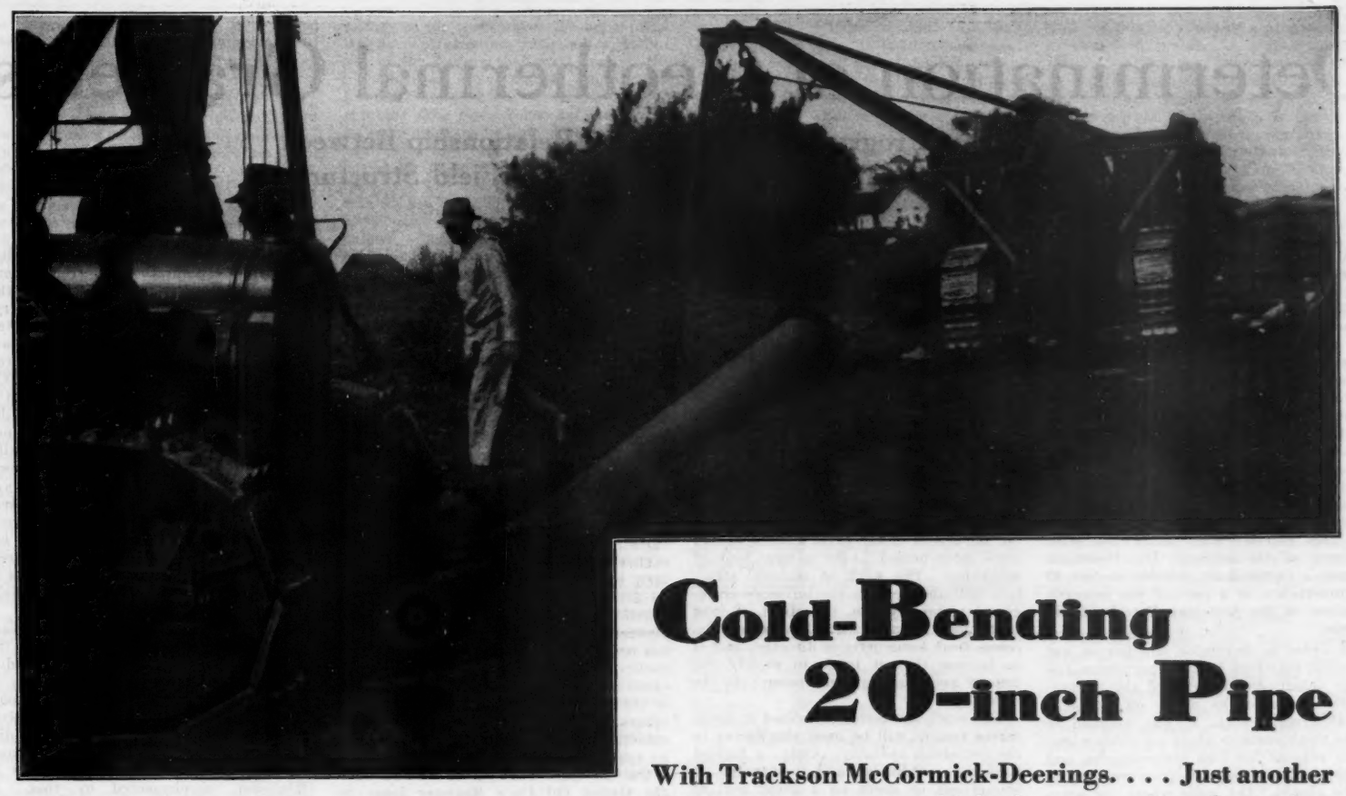
Finished steel prices are fairly well maintained all along the line, and very well. No outright declines are reported. On large orders for construction material there are, of course, special prices.

NEW KENTUCKY BRANCH

Missouri-Kansas Pipe Line Co. has purchased the gas franchises of Hawesville, Ky., and plans construction of a main from a gas reserve near Deanefield to supply the town of Hawesville with natural gas. This will make the third Ohio River market to be supplied with natural gas by Missouri-Kansas, according to Frank P. Parish, president. Owensboro and Henderson, Ky., are the other two.

NORTHLAND OIL TRANSIT

The pipe line gathering system laid in the Muskegon, Mich., oil field by Westlund-Whitehead, Inc., is now known as the Northland Oil Transit, Inc., and is controlled by officials of the Northland Oil Co. of Chicago and of the Michigan Central Refining Co. of Muskegon.



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Determination of Geothermal Gradients

Report on Progress of Research on Relationship Between Variations in Earth Temperatures and Oil Field Structures

By K. C. Heald
The Gulf Companies, Pittsburgh, Pa.*

It has long been known that the temperature increases with depth, at least in the rocks within a few thousand feet of the earth's surface, and that this increase is quite uniform in most localities, but the rate at which temperatures increase with depth varies from place to place. Only comparatively recently, however, has there been any attempt to establish either a direct or an indirect relationship between the variations in earth temperatures and oil fields. The theory that petroleum itself is responsible for heat releasing reactions, and that the presence of oil may be indicated by abnormally high temperatures, has been particularly popular with many European students of the subject. It, therefore, seemed a particularly suitable project to be undertaken as a part of the research program of the American Petroleum Institute.

In order to determine whether or not chemical reactions between petroleum and other substances has caused the temperatures in the rocks above oil fields to be abnormally high, it was planned to make measurements above oil fields where other reasons for high temperatures, and in particular anticlinal structure, seemed to be absent. Oil pools where the accumulations are due to lenticularity, rather than structure, seem particularly suited for such studies. To further confirm the conclusions that might be reached, it was planned to take measurements in wells that have gone through a number of thick oil sands to see if abnormal temperatures exist opposite or near oil bearing sands.

To learn whether radioactivity can be considered responsible, measurements were to be taken in fields where appreciable quantities of helium are known to be present; and studies of the relations between the temperatures and the depth to the granitic basement were also planned, since some of the champions of this idea have pointed out that granitic rocks are commonly higher in radioactive constituents than are sediments; and hence if radioactivity is one of the important reasons for high temperatures, the depth to these granitic rocks should have an influence on the heat in the overlying strata.

The most intensive work would be concentrated on studies of the relationships between geologic structure and earth temperatures, since work already done leaves no doubt that such relationships do exist. On the other hand, while such relationships could not be questioned in certain of the areas that had been studied, in other areas where temperatures were expected to reflect the structure no apparent relationship was found to exist. The problem, therefore, was not merely to establish the fact that structure is frequently reflected in the rock temperatures, but to learn the causes for the reflection, and also for the lack of relationship in some instances. In this study the amount the rocks have been deformed, the recency of the deformation, the thickness of strata that have been stripped from the surface of the fold, the opportunities for leakage of temperature through migration of heated waters up faults or fissures, and other pertinent data were to be considered.

The study of the relation between geologic structure and earth temperatures was so planned that many different types of structures would be considered—the gentle folds of Oklahoma, the faulted monoclines of the Balcones fault zone of Texas, the sharply compressed and crumpled strata of California fields, and the extreme deformation that occurs around the salt domes of Texas and Louisiana. It was also planned to so distribute the work that regional as well as local structures would be involved, and the influence of great basins like that of West Texas and the Anadarko Basin of Oklahoma, and broad uplifts such as the Hunton arch of Oklahoma and the Bend arch of Texas would be learned.

The same work that it is hoped will establish the influence of geologic structure in the distribution of earth temperatures will also serve to establish the effects of unconformities—old surfaces that were for a long time exposed to the cooling influences of the earth's surfaces and were later buried under a new load of sediments. The work on regional structure will also bear on the influence of regional metamorphism, the effect of long continued pressure which, as a rule, comes from some definite direction and is so intense that it tends to modify the density and mineral character of the rocks.

The work has been centralized in areas where results will be most significant to the petroleum industry. Only a limited fund was available; and it was felt it should not be spent on a great deal of scattered work, but that a few areas should be rather intensively studied. Oklahoma, Texas, and California were chosen for study, since they not only offer favorable conditions, but also they are the areas where the results of the work seem best calculated to be of service to the industry.

Work has been in progress in these three states since the spring of 1927, but in all three of the states it has been part time work, so that we may consider that not more than a year and a half has actually been devoted to it. This is really a very short time for a project of this type, and it is felt that the results obtained—and which are briefly mentioned in the following paragraphs—are highly creditable.

Oklahoma

One of the most interesting aspects of the work in Oklahoma has been the effort to bring out the relations between earth temperatures and geologic structure. In considering geologic structure, both the local faulting and folding of anticlines and the broad features involving hundreds of square miles were considered. In order to learn just how these earth temperatures varied in a regional way, the temperatures in wells extending in an irregular line from about 18 miles east of the town of Okemah in Okfuskee County to Oklahoma City in Oklahoma County, a distance of about 100 miles, were measured. This work shows that there is a very definite and quite uniform regional change in the temperature of the rocks.

Whereas a temperature of 100° F. is found in a hole less than 1,500 feet deep a few miles east of Okemah, it is necessary to drill to a depth of 4,100 feet (almost three times as deep) in the Oklahoma City area to reach rocks equally hot. The line representing 100° of temperature is not perfectly straight, which indicates that the change is not perfectly uniform; but it seems likely that many of the apparent irregularities can be explained by the fact that measurements were taken on local anticlines which tended to influence the regional picture.

It may be pure coincidence, but the fact that the rocks slope in the same direction as the 100° temperature line, and at a rate only slightly more abrupt, is thought to be significant. In short, the way the temperature drops into the great basin of central Oklahoma may prove to be definitely a reflection of regional structure. This seems the more probable, because the work in Texas has shown a similar decrease of temperature in the Permian Basin of West Texas. The relationship cannot possibly prove to be as simple as this statement seems to indicate, for other changes have been noted that cannot be explained by regional structure; but at least the possibility exists, and future work must be directed to establish or disprove this possibility.

Local Structure

The work in Oklahoma offered an opportunity to learn whether local structures—anticlines and synclines—in gently folded rocks are reflected by the temperatures in those rocks. Van Orstrand's earlier work in Wyoming—and particularly on the Salt Creek anticline—leaves no doubt that in steeply tilted beds such a reflection can be detected in many instances. McCutchin's work in Oklahoma has tended to substantiate Van Orstrand's earlier work, which shows that while earth temperatures do reflect the folding of the rocks in many instances, there are others where the relation between local structure and earth temperatures are not so apparent.

On the other hand, work in and near the Gypsy Oil Co.'s Shawver lease in the Tonkawa Field shows that surfaces of equal temperature by no means always parallel the geologic structure. The geologic structure on top of the Wilcox sand at this point is a smooth monocline dropping toward the west, while the isothermal surface is an arch or "nose." It is possible that the manner in which the wells on which the measurements were made have been handled may have a bearing on the temperatures the rocks now manifest, but study of the curves based on the temperature measurements do not indicate any such probability. Doubtless there is some simple explanation for this apparent irregularity. It may be, for example, that the temperatures at this particular point reflect structure at greater depth—that under the Shawver lease there is an uplift in the Arbuckle limestone which has not been reached by the drill in this particular spot—but, in any event, it seems unsafe to draw conclusions from the temperature data regarding the attitude of the rocks until further work has shown us the reasons for the apparent exceptions to the rule that structure is reflected, either strongly or faintly, by the isothermal surfaces.

Chemical Action

Oklahoma presents rather ideal conditions for testing the intriguing theory that temperatures higher than normal will be found above oil fields due to heat released through chemical reactions involving oil. If this is true, abnormal temperatures should characterize a great pool like Burbank, in spite of the fact that there has been no deformation of the rocks there. Measurements in the Burbank Field, however, utterly fail to support the theory that high temperatures and petroleum are in any way related.

If chemical reactions involving oil were responsible for abnormal temperatures, it would seem reasonable to expect measurements taken in a well which has passed through several oil sands to show higher temperatures than average at or near the points where the well passes through thick strata known to contain oil. With this thought in mind, J. A. McCutchin made a number of very careful tests in the Tonkawa Field in wells that had passed through three oil sands and were bottomed in a fourth. The temperature curves in these wells seem perfectly normal in every respect, and show no irregularities whatsoever that would even suggest any localization of heating action.

Some students have called upon radioactivity to explain the temperatures encountered beneath the surface of the earth. For example, Frank M. Gentry, in a recently published paper, attempted to show that radioactivity alone can account for known temperatures of the earth's crust down to a depth of 8,000 feet, which is the greatest depth to which the temperatures have actually been determined. The work in Oklahoma has not as yet progressed far enough to justify any definite statements, but it is known that in Oklahoma and Kansas there are accumulations of helium-bearing natural gases, and it is planned to test these areas to see if there is any possible relation between the helium and earth temperatures. No such relationship is anticipated, but it is felt that the matter should be definitely settled.

Some of the advocates of the radioactive theory feel that, inasmuch as the granitic rocks are commonly more radioactive than most sediments, the depth to the granitic basement is of critical importance, and that sediments will be relatively warm or cool in proportion to the distance they lie above the granitic basement. The work that has been done in Oklahoma, supplemented by that in Texas, fails to justify this assumption. More measurements are needed, but in the wells thus far measured the depth to the granite basement has had no apparent relation to the temperature.

Water Circulation

Some of the students of earth temperatures feel that variations in these temperatures are in large part due to the circulation of ground water. The theory is that, as the sediments pack down, the water is squeezed out of the clays or shales, and goes into the porous sandstones and limestones, moving up dip through these porous beds until it finally escapes where the beds crop out at the surface. According to this theory, waters deeply buried in a syncline, such as characterize the general Oklahoma City area, would move up the dip and would result in the temperatures in the "up-dip" areas being somewhat higher at a given depth below the surface of the ground than are those in the syncline whence the waters came. This is precisely what has been observed in Oklahoma, and the regional picture seems to support this conception.

Opposed to this idea, are the results in individual fields and individual wells. If the temperatures are due to circulating waters, it would seem reasonable to expect abnormally cool temperatures above an extensive oil field; for not only are the sands filled with oil so that the hot waters cannot heat up the surrounding rocks, but also the oil should act more or less as an insulator. Measurements in the Burbank and Glenn Pool districts do not support this idea.

The records of the measurements in individual wells also tend to refute this theory. If the heat is influenced by the circulation of abnormally warm waters, we would expect temperatures higher than average in wells at the points where these wells pass through thick water bearing sands. No such abnormalities can be recognized in the wells thus far measured in Oklahoma.

Effects of Unconformities

If sediments have been cooled by a long period of exposure, and then more sediments have accumulated on top of the cooled surface, it seems at least possible that this early period of cooling may be reflected in the temperatures of the rocks. No particular study of this point has been made in Oklahoma, but conditions there are beautifully suitable to permit determining whether or not unconformities can

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 5, 1929.

be detected by this method. It is hoped that the measurements in Oklahoma and in North Texas will leave no question on this point.

Effect of Strong Faulting

Whether or not intense faulting, with the generation of heat by the friction of the rocks sliding over each other, will raise the temperature of the rocks sufficiently, so that this faulting activity may be detected by temperature measurements, probably cannot be determined by the Oklahoma work, since conditions there are not particularly favorable; but it is hoped that the work in Texas and in California will clear up this question.

TEXAS

Stratigraphic Conditions

The sediments in which measurements were taken range in age from Ordovician to Pleistocene. Since sediments have all been at the temperature of the air or the water at the surface of the earth at one time or another, it might be thought that —other things being equal—the oldest sediments would be the warmest since they would, theoretically, have had the greatest length of time in which to receive heat from the underlying warm earth. That is, if we had sediments of Ordovician age and sediments of Pliocene age, each with the same thickness of rocks above them to prevent the escape of any heat, they might receive from below, the Ordovician rocks should be the hottest. The work in Texas supports observations elsewhere to prove that no such relation exists. In fact, rocks of Ordovician age in Texas that are known to have been buried under at least 3,000 feet of other rocks for a much longer time than much younger (Cretaceous) rocks have been similarly buried are, nevertheless, distinctly cooler today than are the younger rocks. Measurements now available almost, if not quite, justify the conclusion that the age of the sediments has nothing to do with the temperature conditions. The work in Texas is very valuable in connection with this particular question, for no such range of age in sediments has been available for testing in the other areas that were selected for study.

Periods of Cooling

The relationship, or lack of such relationship, between the age of the sediments and their temperature must, of course, include consideration of periods of cooling. For example, rocks may be laid down in the sea, and be buried by several thousand feet of other beds. Under such conditions it would seem reasonable to expect them to become rather warm. Then these rocks might be raised above sea level by some great warping of the earth's surface, and the overlying rocks might be worn away by atmospheric processes, leaving the rocks that were once deeply buried close to the surface, so that the heat they had accumulated might be dissipated into the atmosphere. Following this period of cooling, they might be again deeply buried. This sequence of burial and exposure might be repeated two or three times. Under such conditions, it would seem reasonable to believe that the temperature of the rocks that had been exposed to cooling would be less than that of rocks that had never been so exposed. This is called the problem of the effect of unconformities, for the contact between rocks that were exposed to erosion for a long period and were then reburied is called an unconformity. It was hoped that measurements taken in wells that were drilled across such an unconformity, passing within a foot of vertical distance from rocks that are comparatively young into rocks that are much older, would reflect the differences in the ages of the rocks in some manner. No decisive opinion is yet justifiable, but it is hoped that future measurements will leave no doubt as to the answer to this problem. Incidentally although the problem may sound purely academic—actually the location of an unconformity is of the utmost significance and any new method for such a determination will be welcomed by the geologist.

Problem of Unconformities

It should be at least mentioned that the problem of unconformities is a complex one. The difference in the age and the history of the rocks above the unconformity, as contrasted to those below, is but one of the factors that may bear on the temperatures. For example, such unconformities are in many instances very irregular. The rocks below an unconformity may once have been weathered into mountains and valleys, which were later buried by the sediments above the unconformity. The distribution of temperature would then possibly be affected by the distribution of the buried hills and buried valleys. Theoretically, the earth temperature above a buried hill should be slightly higher than that of neighboring rocks the same distance below the surface of the earth, but not above or beside such a buried hill. This particular case has never been definitely proved in the field. Then again, an unconformity is thought to be a surface along which there usually is quite extensive circulation of water. Since some of the students of earth temperatures would explain all the variations by circulation of water, this, obviously, must be considered as a modifying factor. Again, accumulations of oil are not uncommonly found closely associated with unconformities; and those who advocate the idea that chemical reactions involving oil are responsible for temperature irregularities in the rocks might possibly contend that the known association of oil with unconformities is the factor of real importance, and such a contention must, therefore, be provided for in the scientific attack by making measurements in areas where it is certain that oil is absent and cannot, therefore, be related to observed variations.

Relation of Earth Temperature to Structure

No picture of the State as a whole has yet been secured, but it is possible to construct one covering about half the State. This regional picture shows a belt of comparatively high temperature along the Balcones-Mexia-Luling belt of faults, with the temperature increasing with depth at the rate of 1° F. for about 43 feet. West of this belt, in the Central Mineral Region and on into the Del Rio country, Southwest Texas, the rocks are somewhat cooler and the temperatures increase 1° F. for each 50 or 60 feet. Still farther west and northwest, in the Permian Basin of West Texas and in the Panhandle, the rocks are much cooler, the average rate of increase being less than 1° F. for 100 feet. It is furthermore, of interest that the change from the moderately warm rocks of the Central Mineral Region to the abnormally cool ones of the Permian Basin is comparatively abrupt.

It is, therefore, seen that the increase of temperature with depth along the Balcones fault is about three times as rapid as it is in the Permian Basin of West Texas.

Not enough measurements are available to permit any conclusion as to the possible influence of a great, gentle uplift like the Bend arch on earth temperatures. Such measurements as have been taken indicate that the rocks on the arch are moderately warm, but that it would not be possible to outline the arch and ascertain the attitude of the rocks from consideration of temperature data alone.

A few more data are available for the great basin of West Texas than there are for the Bend arch. While these show the rocks of the basin to be cold by contrast to the rocks of some other parts of the state, it cannot be positively stated that the basin could be outlined merely by studying the temperature conditions in wells drilled in and near it. In fact, the study suggests that no such outlining would be possible, for conditions in this basin are much more erratic than in any area considered except the Panhandle. For example, in two wells about 25 miles apart, the temperature in one increased at the rate of 1° F. for every 84 feet and in the other 1° F. for every 137 feet, or a difference of 53 feet per degree Fahrenheit. This contrasts strongly with the Balcones fault district, where the range is only 10°. That is, in abnormally warm parts of the fault zone, the temperature will increase about a degree with each additional 40 feet of depth, and in the cooler parts of the fault zone it will increase about a degree with 50 feet of depth. The Panhandle district shows quite an erratic distribution of temperature, quite comparable to that in the Permian Basin.

Big Lake Field

Comparatively few areas have been studied in detail. Of these, the most striking is the Big Lake Field of Reagan County. The rocks in this field are arched into a rather symmetrical dome, and the detailed study of a group of wells in this field reveals a similar doming manifested by the temperatures. That is, the temperatures are highest near the center of the field and lowest at its edge. The structure of this field is clearly reflected by the temperature measurements. It is an interesting point that if only the measurements down to a depth of 2,000 feet below the surface are considered, no obvious relation between structure and temperature is apparent; but the temperatures at 3,000 feet do show such a relationship.

The Lytton Springs oil field in Caldwell County was studied in some detail, but not in enough to permit final conclusions. There seems to be some relation between structure and temperature, but exact coincidence cannot be demonstrated; and, from the data now available, it seems more probable that the field cannot be exactly outlined by the temperature data than that the reverse is true.

Whether or not there is a sufficiently close relation between temperatures and faults to permit detection of the proximity of faults by means of temperature data remains to be demonstrated. It seems altogether likely that this will be possible, but a good deal more work is needed to prove or disprove it.

Salt Domes Studied

Four salt domes have been studied; three in the Gulf Coast region and one in what is commonly called the "interior salt dome province." In all of them, the same general tendencies were observed. The temperatures both on and near the domes are high compared to West Texas, but somewhat cooler than those in the Balcones fault zone, temperature increasing at the rate of about 1° F. for 50 feet of depth. The most interesting feature of the temperature work on the salt domes, however, is that the highest temperatures seem to be very definitely associated with the salt dome itself. Temperatures are highest above the salt, and the decrease in temperature farther and farther away from the domes is unmistakable. To make the situation even more interesting, the work has shown that temperatures at depths as shallow as 200 or 300 feet are significant. This has not proved true in other parts of Texas.

All of the domes that were tested are of the type that have salt within a few hundred feet of the surface of the ground It is not known whether or not similar conditions will be found above domes like DeWalt or Lost Lake, where the salt is several thousand feet below the surface. It is not thought that very shallow wells will furnish significant data above such domes, but this is merely an opinion which must be confirmed by actual measurements.

The work on the salt domes has shown that, insofar as this type of structure is concerned, the presence or absence of oil has no determinable effect; for on two of the domes—Humble and Blue Ridge—there are important oil fields; and on the other two—Long Point and Grand Saline—there are no oil fields, and the same general relations are found on all four.

From the standpoint of immediate usefulness, these salt dome measurements are more interesting than any of the rest of the work in Texas; for it at least suggests very strongly that salt domes can be located and their general outlines determined by measurements in very shallow drill holes, and it seems at least possible that structural irregularities around the flanks of the domes will also be indicated.

Concentration of Heat

The apparent concentration of heat near the salt domes may perhaps be explained by the fact that salt is an excellent conductor of heat, and the salt column is thought to extend uninterrupted to depths of from 10,000 to 20,000 feet, where high temperatures must exist. Another factor that may contribute is the fact that the salt was all at great depth before it was intruded into the overlying sediments, and it seems probable that it has not yet lost all of its original heat. A third contributing factor may be hot

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SECOND VAN POOL WELL DRILLING IN WITH SLUSH PIT COVERED WITH OIL

By L. E. Bredberg

Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Dec. 2.—The second well of the Van Pool in Van Zandt County, is now drilling in after having set 6⅝-inch casing at 2,598 feet. Total depth is 2,615 feet where plug is being drilled. The slush pit is covered with oil. This well belongs to the Pure Oil Co., is located on its Thompson lease, and a south offset to the company's No. 1 Jarman the discovery well.

Shell Petroleum Corp.'s No. 1 Tunnell is now drilling plug after the casing was set at 2,499 feet, considerably higher than either the discovery or the second well of the Pure Oil Co. Total depth of the Tunnell well is 2,553 feet, 62 feet different than Pure's No. 1 Thompson, with practically the same elevation. Shell's No. 2 Tunnell is setting 6⅝-inch casing at 2,426 feet; total depth is 2,441 feet. Oil sand in this well was topped at 2,425 feet and cored to 2,441 feet.

Within the coming week all three of these wells will probably be drilled in, the first one no doubt completed within two days. The Pure Oil Co. has thirty 1,000-bbl. tanks erected just west of the wells, and two 55,000-bbl. tanks on its farm about 4 miles west, with an 8-inch line from the wells to the tank farm ready to run the oil to storage. The 10-inch line to Chandler and the loading rack at that place will be ready to transport oil within a week, and ready for the production from the three new wells which are about ready to be completed.

The East Texas Oil Corp. is drilling at 1,300 feet on the Kadane farm in Smith County, just east of the Pure discovery well near Van. It will be some time before this well is at a critical depth.

The Deep Rock Oil Co. is building a rotary rig on its No. 1 Bowden or Freeman, about the center of the east half of the northwest quarter of the lease in the Martin N. Lout Survey. This is on a block owned by the company and is made up out of the William Rose, Robert O'Bean, J. K. Bean, Martin N. Lout, Z. Ellison, John McDonald and Bennett M. Neeley Surveys, Smith County.

Anderson County Test

The Humble Oil & Refining Co.'s No. 1 Birdwell, in the northwest part of the S. Bolin Survey, approximately 8 miles west of Boggy Creek, is drilling around 3,420 feet. It topped the Pecan Gap at 3,150 feet and went out of chalk at 3,346 feet. This test is in Anderson County, on the east side.

The Central Oil Co.'s test, on the West ranch near Ben Wheeler in Van Zandt County, set around 200 feet of surface casing and is now temporarily shut down. The Humble Oil & Refining Co.'s core test on the Dodd farm in the C. E. Rivers Survey, is now down below 1,000 feet.

In Cherokee County, the Mid-Kansas Oil & Gas Co. is moving in a rotary derrick on its first core test on the M. A. Sketon 116-acre tract in the north-

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WILDCAT OPERATIONS IN TEXAS PANHANDLE

(Continued from Page 86)

Continental Oil Co.'s No. 1 Slaughter-A, 330 ft. from W, 430 ft. from S lines, League 130, Carson County School land ..... Small S.G. 4,745-50 ft.; T. D. 5,001 ft; P.B. 4,900 ft; oil pay 4,873-88 ft; swbd. 65 bbls. oil and 5 bbls. wtr.

DONLEY COUNTY

Blue Bonnett Oil Co.'s No. 1 Ball, 1,075 ft. from N line, 985 ft. from E line, Sec. 22, Blk. E, D.&P.R.R. Sur. ..... T.D. 3,006 ft; contract depth.
Marine Oil Co.'s No. 1 Sawyer, C SW, Sec. 5, Blk. G, G.C.&S.F. Sur. ..... S.D. 3,510 ft.
Southland Oil Co.'s No. 1 Lewis, C SE 40 ac., Sec. 3, Blk. 29, H.&G.N.R.R. Sur. ..... S.D. 2,570 ft.

GRAY COUNTY

Adams Oil Co.'s No. 4 Morse, 330 ft. S and W, NE cor. Sec. 3, Blk. 26, H.&G.N.R.R. Sur. ..... S.D. 2,495 ft; S.O.
Alexander and Shell Pet. Corp.'s No. 1 Harrah-McKinney, 330 ft. S and W, NE cor. E½ SE, Sec. 163, Blk. 3, I.&G.N.R.R. Sur. ..... Drlg. 2,675 ft.
British-American Oil Co.'s No. 2 Purviance, 330 ft. N and E, SW cor. E 160 ac., Sec. 61, Blk. B-2, H.& G.N.R.R. Sur. ..... Location.
Champlin Ref. and Danciger's No. 3 Cook-Faulkner, 330 ft. S and E, NW cor. W 120 ac. of E 200 ac., Sec. 30, Blk. B-2, H.&G.N.R.R. Sur. ..... Drlg. 400 ft.
Clayton-Key Oil Co.'s No. 1 Key, 330 ft. from S and W of E 42 ac. of N 84 ac. of S 168 ac., Sec. 1, B.&B. Sur. ..... Drlg. 550 ft.
Cons.antine et als' No. 1 Crews, 330 ft. S and W, NE cor. SW, Sec. 20, Blk. 30, H.&G.N.R.R. Sur. ..... Drlg. 2,235 ft; S.G. 2,190 ft.
Danciger et als' No. 11 Jackson, 330 ft. S, 1,320 ft. W, NE cor. NW, Sec. 34, Blk. B-2, H.&G.N. Sur. ..... T.D. 2,906 ft.
Danciger O. & R. Co.'s No. 1 McLarty, 1,220 ft. from S, 330 ft. from W, W½ NW, Sec. 10, Blk. 1, A.C. H.&B. Sur. ..... 12,000,000 ft. gas 2,275-2,350 ft; 50,000,000 ft. gas 2,275-2,490 ft; 18,000,000 ft. gas 2,500-2,620 ft; T.D. 3,375 ft; to P.B. for gas.
Danciger O. & R. Co.'s No. 5 Morse, 330 ft. N and E, SW SW NW, Sec. 1, Blk. 26, H.&G.N.R.R. Sur. ..... Drlg. 1,800 ft.
Danciger O. & R. Co.'s No. 1 Shaw, 330 ft. from S, 336 ft. from E of E 39½ ac., NW, Sec. 5, Blk. 1, A.C.H.&B. Sur. ..... T.D. 2,588 ft.
Danciger O. & R. Co.'s No. 1 Williams, 330 ft. from N, 330 ft. from E, S½ NW ..... Estimated 15,000,000 ft. gas 2,610-70 ft; S.D. 2,720 ft.
Dunlop's No. 4 Morse, 330 ft. N and E SW cor. SW, Sec. 17, Blk. A-9, H.&G.N.R.R. Sur. ..... T.D. 2,431 ft.
Sines & Reiger's (formerly Enlick et als') No. 1 Mrs. J. A. Hopkins, NW cor. W 80 ac. of SW, Sec. 84, Blk. B-2, H.&T.C. Sur. ..... S.D. 3,206 ft.
Gardner Bros. and Collins' No. 2 Saunders, 955 ft. from S, 330 ft. from E of W 68 ac. E½, J. G. Eustice Sur. .. Location.
Gulf Prod. Co.'s No. 1 Barrett, 967 f.. N and E, SW cor. NE, Sec. 131, Blk. 3, I.&G.N.R.R. Sur. ..... Location.
Gulf Prod. Co.'s No. 3 Worley-A, 330 ft. N, 1,650 ft. W, SE SW, Sec. 36, Blk. 3, I.&G.N.R.R. Sur. ..... Temp. abd. at 3,163 ft.
Gulf Prod. Co.'s No. 3 Saunders, 330 ft. S, 990 ft. E, NW cor. its 130-ac. lease out of SW cor., Sec. 40, Blk. 3, I.&G.N.R.R. Sur. ..... Drlg. 1,600 ft.
Guernsey Oil Co.'s No. 1 Pope, 330 ft. from N and W lines, W½ SW, Sec. 173, Blk. 3, I.&G.N. Sur. ..... 4,000,000 ft. gas 2,985-3,070 ft; S.D. 3,290 ft; 1,000 ft. oil in hole 3,-186-90 and 3,285 ft.
Guernsey Oil Co.'s No. 1 Vaniman, 330 ft. N and W, E½ NE, Sec. 175, Blk. 3, I.&G.N.R.R. Sur. ..... S.D. 1,105 ft.
Haymer O. & G. Co.'s No. 1 Morse, 330 ft. each way out of SE cor. E½ SE, Sec. 45, Blk. A-9, H.&G. N. Sur. ..... S.D. 460 ft.
Herragan Oil Co.'s No. 1 Bradford, 330 ft. from N, 990 ft. from E. Sec. 123, Blk. B-2 ..... First S.G. 2,475-80 ft; 15,000,000 ft. gas 2,515-40 ft.; S.D. 3,140 ft.; S.O. 2,932-50 ft.
Hinerman Bros.' No. 1-A Taylor, 330 ft. from NE E½ NE, Sec. 8, Blk. H, A. H. Wallace Sur. ..... S.D. 3,200 ft.
Humble O. & R. Co.'s No. 4 Jackson, 976 ft. N, 330 ft. E, SW cor. E 95.25 ac., Sec. 90, Blk. B-2, H.&G.N. Sur. S.G. 2,271 ft; drlg. 3,020 ft; flowed 180 bbls; T.P. 2,882-90 ft; C.O.
Humble O. & R. Co.'s No. 1 Palmer, 330 ft. from N and E lines, of W 100 ac., Sec. 31, Blk. B-2, H.&G. N. Sur. ..... S.D. 3,120 ft; to pump; P.B. 3,-110 ft.
Lyon et als' No. 1-A Morse, 330 ft. from S and W, NW NW, Sec. 1, Blk. 26, H.&G.N.R.R. Sur. ..... Rig.
Magnolia Pet. Co.'s No. 7 Bowers, 990 ft. S and E, NW cor. NW, Sec. 62, Blk. B-2, H.&G.N.R.R. Sur. ..... Drlg. 2,982 ft; T.P. 2,855 f.; I.P. 150 bbls. first 24 hrs.
Magnolia Pet. Co.'s No. 4 Magnolia, 990 ft. S and 330 ft. W, NE cor. NE, Sec. 11, Blk. 3, I.&G.N.R.R. Sur. .. Drlg. 2,795 ft.
Magnolia Pet. Co.'s No. 1 Wright, 330 ft. S and W lines, S½ SW, Sec. 13, Blk. 3, I.&G.N. Sur. ..... 15,000,000 ft. gas 2,707-10 ft; S.D. 2,710 ft.
McAuley et als' No. 3 Morse, 330 ft. S and E, NW cor. S½ NE, Sec. 2, Blk. 26, H.&G.N.R.R. Sur. ..... Fishing 2,470 ft; S.O. 2,410 ft; 100 ft. oil in hole 2,442 ft.
Oil Operators' No. 1 Bowers, 330 ft. from N, 330 ft. E, Sec. 93, Blk. B-2, H.&G.N. Sur. ..... Show oil and gas 2,400-17 ft; S.D. 3,090 ft; S.O. 3,036-55 ft; first gas 2,483 ft; increased at 2,500 ft., 2,544 ft. and 2,950 ft.
Operators Oil Co.'s No. 1 Lovett, 330 ft. from N and W lines, W½ NE, Sec. 57, Blk. B-2, H.&G.N. Sur. .. Gas 2,390 ft; S.O. 2,837-47 ft; T. D. 3,061 ft; P.B. 2,880 ft.; shot 280 qts. from 2,830-80 ft.; swabbed 17 bbls. in 3 hrs.; to pump.
Operators Oil Co.'s No. 5 Cook-Faulkner, 990 ft. N, 330 ft. W, SE W 90 ac., Sec. 30, Blk. B-2, H.&G.N. Sur.. S.D. 2,743 ft.
Operators Oil Co.'s No. 6 Cook-Faulkner, 330 ft. S and E, NW cor., Sec. 30, Blk. B-2, H.&G.N.R.R. Sur. .... S.G. 2,424 ft. and 2,477 ft; S.D. 2,750 ft.
Operators Oil Co.'s No. 7 Cook-Faulkner, 330 ft. S, 330 ft. E, NW cor., Sec. 30, Blk. B-2, H.&G.N. Sur. ..... S.G. 2,380 ft; S.D. 2,691 ft.
Phillips Pet. Co.'s No. 5 Jackson, 330 ft. from N, 990 ft. from E, line, S½ NE, Sec. 38, Blk. B-2, H.&G. N.R.R. Sur. ..... T.D. 3,030 ft; fishing pipe.
Phillips Pet. Co.'s No. 6 Palmer, 330 ft. S and W, NE cor., Sec. 31, Blk. 2, H.&G.N.R.R. Sur. ..... S.D. 2,743 ft.
Plains Drlg. Co.'s No. 1-A Chapman, 330 ft. from S and W, NE, Sec. 10, Blk. 26, H.&G.N. Sur. ..... S.G. 2,240 ft; 15,000,000 ft. gas 2,240-90 ft; T.D. 2,765 ft; 300 f.. oil in hole; shot 230 qts. from 2,580-2,740 ft; C.O.
Queen Oil Co.'s No. 1 Lovett, 330 ft. N and W, W½ NE, Sec. 35, Blk. B-2, H.&G.N.R.R. Sur. ..... Rigging up.
Quillian et als' No. 1 Barrett, 330 ft. from N, 330 ft. from E, Sec. 131, Blk. 3, H.&G.N. Sur. ..... 20,000,000 ft. gas 2,660-2,705 ft; drlg. 3,120 ft; S.O. 3,100 ft.
Ray et als' No. 1 Noble, 240 ft. from S and 330 ft. from W line, W 80 ac., SW, Sec. 10, Blk. A-6, H. &G.N. Sur. ..... T.D. 2,636 ft.
Rieger & Steckoll's No. 1 Bohr, 330 ft. from S and E, Sec. 37, Blk. B-3, H.&G.N. Sur. ..... Drlg. 1,200 ft.
Robertson & Devore's No. 1 Saunders, 330 ft. from S and W, E½ NW, Sec. 40, Blk. 3, H.&G.N.R.R. Sur. .. Rigging up
Shamrock O. & G. Co.'s No. 3 Saunders, 330 ft. N and E, SW E½ SE, Sec. 4, Blk. 1, A.C.H.&B. Sur. ..... S.D. 2,438 ft.
Shamrock O. & G. Co.'s No. 1 Taylor, 330 ft. each way out of NE cor. NW, Sec. 1, Blk 2, H.&G.N. Sur. .... Fishing 1,490 ft.
St. Clair Oil Co.'s No. 1 Dial, 330 ft. S and W, NE cor. SE, Sec. 10, Blk. 25, H.&G.N.R.R. Sur. ..... Spudded and S.D.
St. Clair Oil Co.'s No. 1 L. S. Stockton, SE cor., Sec. 35, W. R. Lee Sur. ..... Spudded and S.D.
Stogner Meaders' No. 1 Taylor, 330 ft. from S and E, SW, Sec. 7, Blk. H, A. H. Wallace Sur. ..... 1,000,000 ft. gas 2,490-2,535 ft; 2,000,000 ft. gas; T.P. 2,490 ft; T.D. 3,014 f.; S.O. 2,920 ft. and 2,992 ft.
The Texas Co.'s No. 3 Combs-Worley, 330 ft. N and W, SE cor., Sec. 26, Blk. 3, I.&G.N. Sur. ..... 4,000,000 ft. gas 2,135-40 ft; S.D. 2,710 ft.
The Texas Co.'s No. 8 Cook-Faulkner, 1,153 ft. N, 1,835 f.. W, SE cor., Sec. 29, Blk. B-2, H.&G.N.R.R. Sur.. Location.
The Texas Co.'s No. 3 McLarty-B, 1,326 ft. S, 660 ft. E, NW E½, Sec. 10, Blk. 1, A.C.H.&B. Sur. ..... 4,000,000 ft. gas 2,135-40 ft.; S.D. 2,920 ft.
The Texas Co.'s No. 14 Saunders, 955 ft. N, 330 ft. W, SE cor. W½, J. G. Eustis Sur. ..... S.D. 2,510 ft.
The Texas Co.'s No. 15 Saunders, 330 ft. N and W, SE cor. W½ SE, Sec. 4, Blk. 1, A.C.H.&B. Sur. .... S.D. 2,600 ft.
Travis & Rieger's No. 1 Mackie, 330 ft. from N and E, Sec. 114, Blk. B-2, H.&G.N.R.R. Sur. ..... Drlg. 2,420 ft.
Travis et als' No. 1-B Webb, 330 ft. N and W, Sec. 61, Blk. 25, H.&G.N.R.R. Sur. ..... Location.
Trippiehorn Oil Co.'s No. 1 Morse, 330 ft. from S and W, SW SE, Sec. 17, Blk. A-9, H.&G.N.R.R. Sur. ..... Rig.
White Eagle O. & R. Co.'s No. 3 Faulkner, 1,158 ft. N, 330 ft. E, SW cor. E 80 ac., Sec. 29, Blk. B-2, H. &G.N.R.R. Sur. ..... Drlg. 1,385 ft.
Wright Wilson, trustee's No. 1 Chapman, 175 ft. from S and E lines, N½ NW, Sec. 69, Blk. 25, H.&G.N. Sur. S.D. with S.O. 2,685 ft.
Wilcox-Pampa Oil Co.'s No. 10 Combs-Worley, 330 ft. S and W, NE cor. SW SW, Sec. 35, Blk. 3, I.&G. N.R.R. Sur. ..... Drlg. 2,707 ft.

HOCKLEY COUNTY

World Oil Co.'s No. 1 Ellwood, 330 ft. from N and W lines, League 7, Wilbarger County School lands; elevation 3,363 ft; contract depth 5,000 ft. ..... S.D. 3,250 ft.

HUTCHINSON COUNTY

Alamosa Oil Co.'s No. 4 Sanford, 310 ft. S, 320 ft. W, NE cor. N 160 ac., S 240 ac., Sec. 85, Blk. 46, H.& T.C. Sur. ..... S.O. and wtr. 3,010-11 ft; S.D. 3,-095 ft.
Danciger O. & R. Co.'s No. 3 Moore, 330 ft. S and E, NW W½ SE, Sec. 125, Blk. 4, I.&G.N.R.R. Sur. .... Drlg. 2,425 ft.
Huey et als' No. 3 Smith et al, 330 ft. from N, 660 ft. from W, S 40 ac. of E 100 ac., SE, Sec. 13, Blk. Y.. Fishing 2,702 ft.
Midwes. Expltn. Co.'s No. 3 Moore, 330 ft. N, 330 ft. W, SE NE, Sec. 125, Blk. 4, I.&G.N.R.R. Sur. ..... Drlg. 350 ft.
Oates & Jones, No. 1 Jasper, 450 ft. S, 330 ft. W, NE 121-ac. tract, Sec. 23, Blk. M-23, T.C.R.R. Sur. ..... Drlg. 602 ft.
O. B. Penney's No. 2 Johnson Bros., 330 ft. from S line, 330 ft. from W line, W½ NE, Sec. 35, Blk. Y, A.&B. Sur. ..... 31,000,000 ft. gas 1,990 ft; S.D. 3,-060 ft; S.O. 3,040-45 ft; I.P. 60 bbls.
Reliance O. & G. Co.'s No. 2 Sanford, 330 ft. S and E, NW W½ of N 80 ac. of S 320 ac., Sec. 83, Blk. 46, H.&T.C. Sur. ..... Fishing 2,520 ft.
Skelly Oil Co.'s No. 2 Lee Bivins, 306 ft. from E, 1,242 ft. from S line, S 160 ac. of N 320 ac., Sec. 84, Blk. 46, H.&T.C.R.R. Sur. ..... S.D. 3,015 ft.; T.P. 3,010 ft.; 400 f.. oil in hole.
Smith & McDaniel's No. 1 Pitcher, 330 ft. from S and E, Sec. 19, Blk. M-21, T.C.R.R. Sur. ..... Drlg. 767 ft.
The Texas Co.'s No. 3 Moore, 330 ft. S, 1,338 ft. E, NW cor. SW, Sec. 125, Blk. 4, I.&G.N.R.R. Sur. .... Drlg. 2,530 ft.
The Texas Co.'s No. 4 L. Moore, 330 ft. S and W, NE cor. SW, Sec. 125, Blk. 4, I.&G.N.R.R. Sur. .... Drlg. 625 ft.
Travelers Oil Co.'s No. 2 Cockrell, 350 ft. from E and S lines, Sec. 8, Blk. B-3, D.&S.E. Sur. ..... 1,000,000 ft. gas 2,610-2,770 ft; T. D. 3,039 ft; T.P. 3,010-39 ft; averaging 60 bbls. daily; shot 120 qts. from 3,010-39 ft; C.O.

LAMB COUNTY

Graham O. & G. Co. et als' No. 1 Ellwood, CWL, Sec. 9, Blk. T, T. A. Thompson Sur. ..... S.D. 3,635 ft.

LIPSCOMB COUNTY

Brown et als' No. 1 Box T Ranch, SW NE, Sec. 612, H.&T.C. Sur. ..... Underreaming 6¾-in. csg.; T.D. 3,625 ft
Okla. Public Service Co.'s No. 1 C. W. Jones, NE SW, Sec. 100, H.&T.C. Sur. ..... S.D. 4,790 ft.

LUBBOCK COUNTY

Center Oil Co.'s No. 1 Bowles Ranch ..... Small S.O. 1,133-40 ft; fishing 4,-167 ft.

MOORE COUNTY

Amarillo Oil Co.'s No. 1 Perkins-A, 330 ft. each way out of NW cor. NE, Sec. 76, Blk. 3 ..... Drlg. 3,575 ft.
Canadian River Gas Co.'s No. 1-C Sneed, 660 ft. from N and E, SW, Sec. 46, Blk. 6-T, T.&N.O.R.R. Sur. .. Rigging up.
Dana O. & G. Co.'s No. 1 Anthony, C NW, Sec. 260, Blk. 44, H.&T.C.R.R. Sur. ..... Drlg. 3,280 ft.
Fritch O. & G. Co.'s No. 1 Lee Bivins, C N 40 ac. of N 160 ac., Sec. 4, Geo. Mahan Sur. ..... 2,000,000 ft. gas 1,550-65 ft; S.D. 2,225 ft.
Red River Gas Co.'s No. 1 J. M. Shelton, 330 ft. each way from SE cor., Sec. 52, Blk. 3, G.&M. Sur. ..... S.D. 1,950 ft.

MOTLEY COUNTY

Expltn. Co.'s No. 5 Matador, C, Sec. 45, Blk. J-B, C, B.&C.N.G.R.R. Sur. ..... S.D. 3,915 ft.
Expltn. Co.'s No. 6 Matador, 330 ft. from N line, 330 ft. from E line, Sec. 132, Blk. M ..... S.D. 3,880 ft.
Matador Oil Corp.'s No. 1 Owens, C NE, Sec. 10, Blk. G, B.&B. Sur. ..... S.D. 580 ft.

POTTER COUNTY

Canadian River Gas Co.'s No. 1 Allison "A," 386 ft. from E line, 5,439 ft. from S line, Sec. 1, W. T. Palmer Sur. Drlg. 2,120 ft.

RANDALL COUNTY

W. A. Patterson's No. 1 Palo Duro, Sec. 60, Blk. K-14 .. S.D. 1,250 ft.

ROBERTS COUNTY

Big Bend Oil Co.'s No. 1 Ledrick, Sec. 7, Blk. A-5 ..... T.D. 5,992 ft; shot 10 qts. 5,270-93 ft; S.O. 5,288 ft; C.O.

WHEELER COUNTY

Lela O. & G. Co.'s No. 1 Williams & Laycock, 330 ft. from S, 209 ft. from W, W½ NW, Sec. 20, Blk. A-8, H.&G.N. Sur. ..... Fishing 1,755 ft.
Lone Star Gas Co.'s No. 1 Simms, C SW NE, Sec. 103, Blk. 23, H.&G.N.R.R. Sur. ..... Spudding.
Magnolia Pet. Co.'s No. 2 Laycock, 680 ft. N, 700 ft. E, SW cor. S½ SW, Sec. 10, Blk. 27, H.&G.N.R.R. Sur.. T.D. 1,710 ft.
Martin & Debous' No. 2 Close, C NE NE, Sec. 83, Blk. 23, H.&G.N.R.R. Sur. ..... Spudding.
Upham Gas Co.'s No. 5 Close-Gooch, 20 ft. N, 660 ft. E, SW cor. SW NW, Sec. 81, Blk. 23, H.&G.N.R. R. Sur. ..... Location.
Upham's No. 1 Cuddleback, C SE SE, Sec. 2, Blk. 24, H.&G.N.R.R. Sur. ..... Rigging up.
Vaughn et als' No. 3 Ackley, 330 ft. from N, 330 ft. from W, Sec. 4, Blk. 27, H.&G.N. Sur. ..... T.D. 1,840 ft; 5,000,000 ft. gas 1,-660-1,770 ft; junked hole; skidding rig 60 ft. south.
Wischkamper et als' No. 1 Curry, C NE SE, Sec. 53, Blk. 23, H.&G.N. Sur. ..... 10,000,000 ft. gas 1,750-90 ft.; S.D. 1,850 ft; T.P. 1,790-1,805 ft.

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Pressure Still Corrosion Problems

High Temperatures Greatly Increase Rate and Make It Imperative to Protect Equipment Against Reduction of Strength

By Walter G. Whitman and J. K. Roberts
Standard Oil Co. (Indiana), Whiting, Ind.*

Perhaps the most serious corrosion problem existing in refinery operation at the present time is that occurring in cracking equipment. The high temperatures employed greatly increase the corrosion rates, and the use of high pressures makes it imperative from a safety standpoint to protect equipment against the reduction of strength by corrosion.

The advent of pressure stilling introduced the problem of combating corrosion due to hydrogen sulphide at elevated temperatures. Improvement in the technique of cracking, such as the use of more extreme pressures and temperatures and pipe still heating with accompanying higher velocities, increased the seriousness of the problem, both because of greater specific rates and because increased investment charges and increased capacities result in larger penalties due to shutdowns and replacements. The present refining of high sulphur crudes has further intensified the difficulty, until it looms as a major item in pressure still design and operation.

Refiners, manufacturers of equipment, and metallurgists specializing in corrosion and heat resisting alloys have all

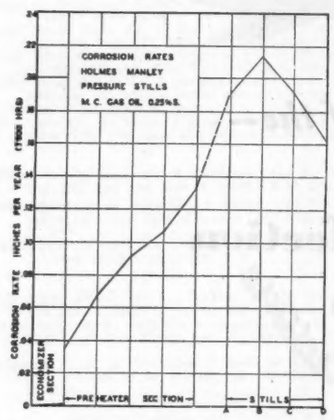

Figure 1.

contributed to the progress in reducing corrosion which has been made during the past few years. The General Committee on Corrosion of the American Petroleum Institute is endeavoring to collect and disseminate the available information on methods which have proved successful or indicate promise. It is the purpose of this paper to describe in a more general way some of the preventive measures which are being employed. In doing this, the factors affecting corrosion in pressure stills will be discussed in order to lay a foundation for the discussion of combative measures. Much of the information contained in this paper has been accumulated through the efforts of the Institute's corrosion committee and its individual members.

Rate of Penetration

The intensity of pressure still corrosion may be perceived from the specific rates of penetration experienced. An average penetration rate on steel of one-fifth of an inch per year with no preventive treatment is commonly encountered with stocks which would be classed as relatively noncorrosive. Stocks from sour West Texas crudes may cause corrosion rates well in excess of one inch per year in some parts of the equipment. With these very rapid rates of corrosion, expensive preventive methods are often justified.

In deciding to what extent corrosion preventive measures should be employed, all of the economic factors should be carefully balanced. Most obvious, of course, is the cost of replacement of materials and labor of installation. Second, the annual investment charges to be made against a cracking unit are increased by the necessity of shutting down the equipment for replacements. Even more important may be the loss of profits occasioned by shutting down cracking capacity in refineries which do not have excess cracking facilities, or which must utilize older and less efficient units to maintain capacity. Finally, there are the intangible items of safety and morale to be considered, as well as the necessity for more frequent and elaborate inspections when corrosion preventive measures are not employed.

Factors Affecting Corrosion

The corrosion encountered in cracking equipment is due to hydrogen sulphide present in the charging stock or formed during cracking. The direct reaction of hydrogen sulphide with iron at low temperatures is extremely slow in the absence of liquid water, but at high temperatures this direct reaction becomes quite rapid. Two fundamental factors affecting the rate of corrosion of iron by hydrogen sulphide are the temperature and the concentration, i.e., partial pressure at the reacting surface. The change in rate of reaction with increasing temperature is quite rapid, and is indicated as doubling with each increase of 25° to 30° F. in temperature.

The factors affecting the concentration of hydrogen sulphide at the reacting surface are numerous. Obviously, the quantity of hydrogen sulphide originally present in the charging stock or formed during cracking is the first contributing

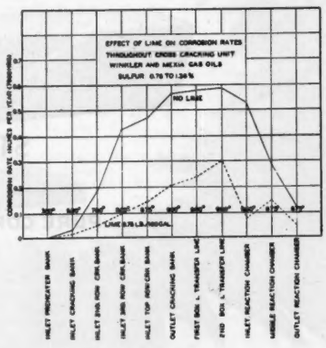
EFFECT OF LIME ON CORROSION RATES
THROUGHOUT CROSS CRACKING UNIT
WINKLER AND MEXIA GAS OILS
SULFUR 0.75 TO 1.34%
NO LIME
LIME 0.5 LB./BBL. FEED
CORROSION RATE INCHES PER YEAR (TWOOD)
INLET PRIMEATER BANK
INLET CRACKING BANK
INLET 2ND ROW CRK BANK
INLET 3RD ROW CRK BANK
INLET TOP ROW CRK BANK
OUTLET CRACKING BANK
FIRST BRK. L. TRANSFER LINE
2ND BRK. L. TRANSFER LINE
INLET REACTION CHAMBER
MIDDLE REACTION CHAMBER
OUTLET REACTION CHAMBER

Figure 2.

factor. Second, the total pressure on the system directly affects the partial pressure of the hydrogen sulphide of given volume per cent. Third, the velocity and turbulence of the oil and vapor is of major importance, both because they affect the conduction or diffusion of hydrogen sulphide to the reacting surface, and because these factors may prevent the formation of, or eliminate by erosion, a protective coating of coke or corrosion product. Fourth, protective coatings, either artificial or formed by corrosion or cracking to coke, may greatly reduce the rate of corrosion by isolating the corroding surface.

In Figure 1 are shown the corrosion rates in various sections of a Holmes-Manley pressure still running mainly on stock from Mid-Continent crude. In Figure 2 a plot is given of the corrosion rates in various parts of a Cross pressure still operated on stock from Winkler and Mexia crudes. The data for the Cross unit were furnished by The Pure Oil Co. These data indicate clearly the effect of increasing temperature and cracking and decreasing turbulence on corrosion. As the temperature increases through the tube still, the corrosion rate increases rapidly. In the Cross unit, when the velocity and turbulence are decreased and coke deposition increases in the soaking drum, however, even with a greater amount of hydrogen sulphide formed by cracking and a temperature only slightly lower, the corrosion rate decreases rapidly.

Methods of Combating Corrosion

Numerous methods of combating corrosion have been tried for various parts of pressure still equipment. Probably the most common is the use of metal walls in excess of the thickness required for strength, allowing the metal to corrode away until the minimum allowable thickness is reached.

This procedure is generally adopted in design at the present time, and has met with success in certain cases where the corrosion rate is low. With severe corrosion, however, it is not practicable to make sufficient allowance to withstand corrosion over a long period of time. Further, the difficulties of manufacture and handling, as well as increased cost, may become excessive, and in some cases heat

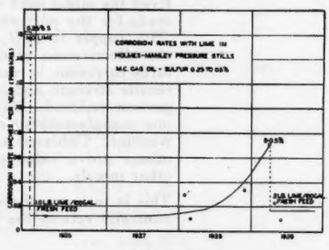
CORROSION RATES WITH LIME IN
HOLMES-MANLEY PRESSURE STILLS
M.C. GAS OIL - SULFUR 0.25 TO 0.5%
NO LIME
0.5 LB. LIME/BBL. FRESH FEED
0.25 LB. LIME/BBL. FRESH FEED

Figure 3.

transmission through thick walls as affecting metal temperature becomes a limiting factor. Careful periodic drillings and inspection for pitting or nonuniform corrosion are, of course, necessary to insure safe operation and determine the time for replacement.

Three general methods of decreasing corrosion are: reducing the corrosiveness of the charging stock, increasing the resistance of the metals, and isolating the metal from the corrosive stock by linings, by the use of plated metals, or by protective coatings.

The corrosiveness of the charging stock may be greatly reduced by employing some agent which will react readily with the hydrogen sulphide. One measure which has met with excellent success in many cases is the use of lime added to the feed before it enters the system. Table 1 gives the results of a series of tests made on a Holmes-Manley pressure still before and after the addition of lime. In this case, the total sulphur content of the charging stock was 0.25 per cent, and approximately 1.0 pound of hydrated lime was added per 100 gallons of cold feed.

(Continued on Page 183)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 4, 1929.

ACTIVE WEEK IN WESTERN KENTUCKY DRILLING MANY STRAY SAND TESTS

By Whit
Staff Correspondent, Kentucky-Tennessee

OWENSBORO, Ky., Dec. 2.—Another active week has passed in the oil fields of western Kentucky, although few large producers were uncovered, as operators are paying more attention to drilling in advance of production in hope of extending the Stray sand areas of northern Ohio County. One of the interesting wells was the test of Root and Young on the Nancy Wigginton farm, an offset to the Vincent Steel wells near Buford and northwest of the Barnett's Creek Church lot, in northern Ohio County. This well found its oil in the Stray sand and looks like a northwestern extension to the Church Pool, and makes the territory around the well-known Chicken farm look inviting as the new well is estimated good for around 75 bbls. Numerous dry holes are reported from the Deanfield area of Ohio County, but regardless of this the work continues there in hope of finding extensions to present production.

Garrison and Evans brought in another fine producer on the Davies heirs' lease, in the Red Hill Pool, of Daviess County. The Mecca Oil Co. extended the Jones Pool southwest of Whitesville to some extent by the drilling in of a fair well on the J. H. Fuqua farm, near Grandview School and north of the Jones Pool. Henderson County makes a good showing and it looks as though a nice productive field is in the making. The Greenville Field in Muhlenberg County reports four dry holes and one oil well, which is on the Corley farm and reported among the good producers so far found in that county. Hopkins and other southwestern Kentucky counties are being looked over by the scouts and large blocks of acreage being leased for wildcatting during the coming spring.

Week's Work

A summary of the week's work in Kentucky shows 36 completions, 17 producers with an initial production of 1,195 bbls., 15 dry holes and 3 gas wells.

County—	Comp.	Oil wells	Prod.	Dry	Gas
Ohio	21	7	510	11	2
Daviess	5	5	215	0	0
Muhlenberg	5	1	200	4	0
Henderson	2	2	200	0	0
Hopkins	1	1	50	0	0
Warren	1	1	20	0	0
Hancock	1	0	0	0	1
Total	36	17	1,195	15	3

Ohio County Wells

The best of the late completions in the Ohio County fields is Hupp and Duff's No. 14 on the Ellis Bartlett 54 acres, in the Bartlett Pool, southwest of Taffy, which produced an initial of 150 bbls. No. 15 same farm, produced 50 bbls.

In the Deanfield area, S. H. Russell and others' No. 3 on the W. Midkiff 88 acres, produced 60 bbls. initial. In this well a string of 684 feet of casing was set, sand from 690-708 feet, total depth 710 feet, and shot with 100 quarts.

Leeper Oil Co.'s No. 4 Tom Westerfield farm, in the Whittaker Pool, produced 65 bbls. at 670 feet.

Cumberland Petroleum Co.'s No. 2 on the G. W. Kirk farm reported at 50 bbls., while No. 1 is also a good producer.

Root & Young's No. 1 on the Wigginton farm, adjoining the Chicken farm, in the Jolly Pool, near Burford to the

(Continued on Page 186)

In the Tight Places . . . . . .

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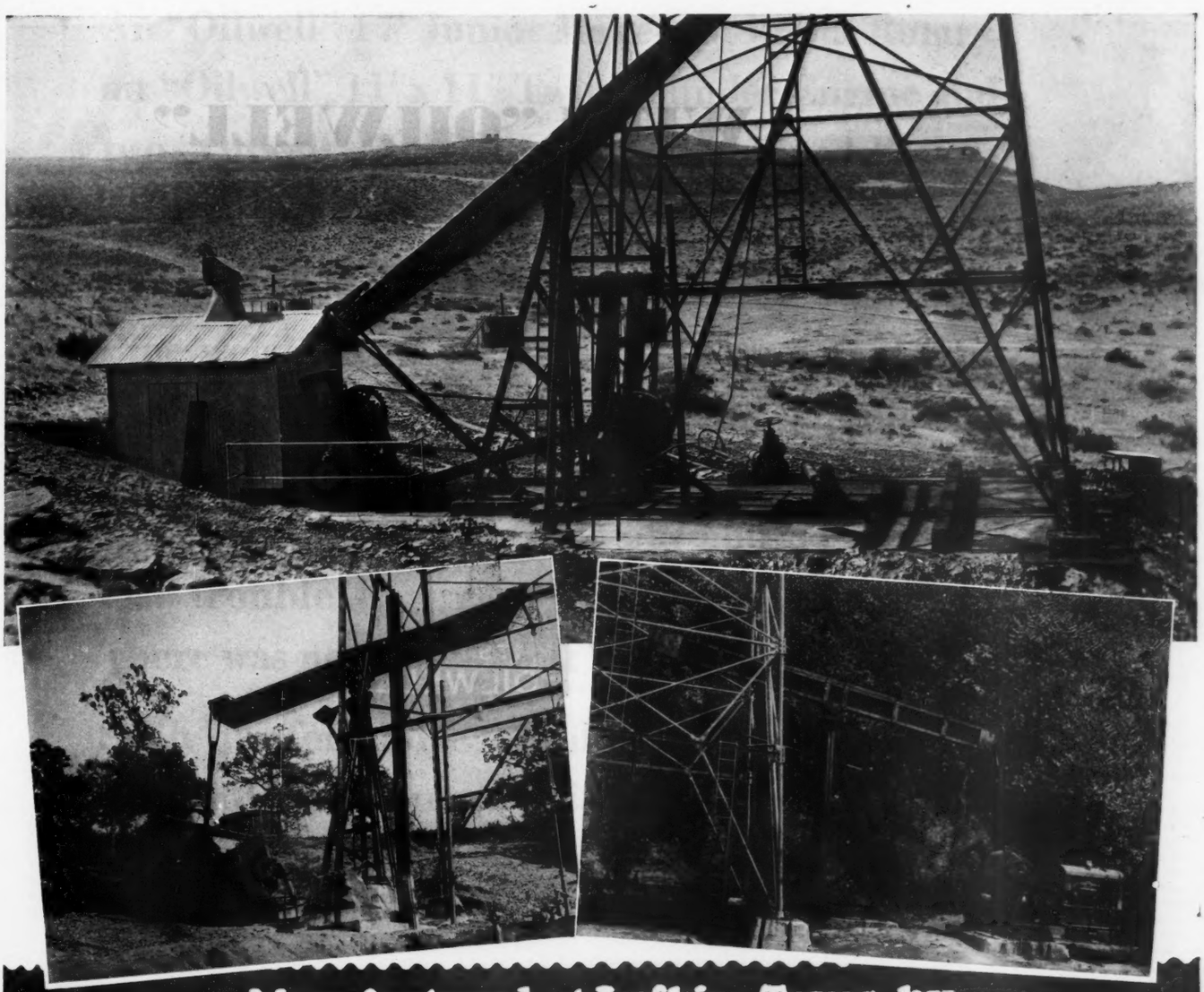

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BRANCH STORES
IN ALL OIL FIELDS

Field Problems and Their Solution

EDITED BY THOMAS F. SMILEY

In order that men connected with the drilling, producing and transporting branches of the petroleum industry may procure quickly a solution of many problems confronting them from time to time in their work, The Oil and Gas Journal has arranged with leading engineers and other recognized authorities to answer questions submitted by readers of this publication pertaining to the work of drilling and producing crude oil and transporting this product.

Everyone is invited to submit questions freely. These questions will be submitted to proper authorities by Mr. Smiley, who edits the page, and answers, based on the best available information, will be published. Each question should give as much detail as possible, especially where it relates to matters where depths of sands, types of sands and operations on adjoining properties would have a bearing on the problem involved. The source of all questions will be considered as confidential and only initials will be published in connection with the question.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or practices which are improvements.

In case an immediate answer is important, one will be given by mail if the writer requests it.

SIGNIFICANCE OF SALT BEDS

In the drilling of a well for oil do the strata indicate possible good production when salt is encountered at various depths three times before entering the "brown lime"? I noticed one of the wells of the Big Lake Oil Co. having passed through salt three times. Can you tell me something about such log records of famous producing wells?

Since you published a piece on "Production per Foot Acre" in your issue of February 21, 1929, have you given another article on the same question? If you have, please advise me as to the issue. Otherwise please give me the specific information.

Will you please inform me what the University of the State of Texas received in royalties from the producing wells in 1926, 1927, 1928 and 1929? How many did this include and the acreage covered?

How much royalty in barrels and money, as an equivalent, has been paid to Texas holders of royalty in these same years? The same information to cover Oklahoma.

How much royalty out of oil has the United States Government received from producers in the years named?

How much royalty have the Osage Indians received from their lands to date and what amount of acreage is represented?—E. S.

As to the relation between salt beds and oil-producing strata you do not say where the area in which you are interested is located, but it is inferred that you have West Texas conditions in mind. If this is the case, it may be said in reply that there does not seem to be any special geological significance in the fact that the well has passed through one or more salt domes. This department is not able to confirm the statement that one of the deep wells of the Big Lake Oil Co. has passed through salt three times, although it might be a fact. A copy of the official log of the Texon No. 1 University (now owned by the Continental Oil Co.) only shows salt formations between 1,110 and 1,655 feet below the surface or approximately 6,870 feet above the pay formations. In addition to this the log shows that all limes found within several hundred feet of the top of the pay horizons were either black or gray, the black predominating, so your reference to the "brown lime" is not quite clear. If you can provide a more detailed statement of the area you have in mind it may be that this department can give you additional information, but no reason is apparent for attributing any significance to the occurrence of salt above limes in the West Texas wells.

No further articles on "Production per Acre Foot" have been published by The Oil and Gas Journal since the one to which you refer. What "specific information" you desire is not clear.

For information concerning the royalties received by the University of Texas address that institution at Austin, Tex.

To ascertain the amounts received by royalty owners in Texas and Oklahoma obtain the annual reports of the United States Bureau of Mines for the years named and divide the total figures on production for each of these states by eight.

To find out what the United States Government has received in oil royalties in any year address the Department of the Interior at Washington, D. C.

Concerning royalties received by Osage Indians and the acreage involved address the Office of Indian Affairs, Department of the Interior, Muskogee, Okla.

LINING TEMPORARY RESERVOIR

Where they make temporary reservoirs in the earth to store oil from new wells I understand that in the big oil fields they cover the face of these reservoirs with cement. Does the saving of oil pay for this extra expense? Do any special directions have to be followed in lining a reservoir with cement in this way?—E. Y. E.

The growing practice of lining temporary storage reservoirs in the oil fields with concrete would seem to show that producers find it profitable to assume this additional expense. Without such a facing heavy losses have been incurred through seepage of oil into porous earth. The United States Bureau of Standards made exhaustive tests for the Concrete Ship Section of the Emergency Fleet Corp. to ascertain the effectiveness of concrete as a retainer of oil. The results of these tests are summarized as follows:

"1. Various mineral oils covering practically the entire range of fuel oils varying in gravity from 0.747 to 0.959 have been stored in concrete tanks 13 months without injury to the concrete in the slightest degree.

"2. Concrete test cylinders 6-inch by 12-inch have been stored in these oils during the same period and have shown no appreciable diminution in compressive strength."

On the subject of building temporary storage reservoirs for oil, "Concrete in the Petroleum Industry," published by the Portland Cement Association, says:

"An oil-tight lining can be attained by taking ordinary care to make a dense compact concrete in which the coarse aggregate is thoroughly embedded in the mortar. Concrete to be oil-tight or water-tight must be placed in a plastic consistency that can be puddled readily into place so as to avoid honeycombing or segregation. Proper mixtures and consistencies can be found by trial, and exact mix and water-cement ratio specified.

"Another method of obtaining the desired results is to specify the water content not to exceed the 6 gallons per sack of cement and to allow aggregate combinations to be used which will give puddling consistency without segregation or accumulation of water."

If you contemplate making a concrete-lined reservoir you can obtain helpful literature and advice from any one of the branches of the Portland Cement Association.

WIND BREAK TO FIGHT FIRE

In the occasional fires that destroy the homes of workmen in this field it has occurred to me that if we just had some way of removing or at least decreasing the effect of the wind that fans the blaze we could save a great deal of property. Can you tell me whether any such thing has been tried and with what success? And how was it made?—L. E. N.

The Carter Oil Co. is using a windbreak to serve just such a purpose as you name. This windbreak, built by the company's own workmen, was made of old pipe welded together as a frame and covered with sheet steel. In case of a fire in the company camp this device is run up on the windward side of the burning building, its jointed top section swung into position and held upright by means of chains. In this position the shield is higher than any ordinary camp building and effectually prevents the wind from fanning the flames.

Two of these windbreaks are stationed in the Carter company's camp just north of Seminole, Okla., on the road to the Searight Field. The camp, like many others is enclosed by fence. Gaps have been left in the fence so that the shields can be moved in quickly to any building. A crosspiece on the pipe tongue makes it possible for several men to take hold and pull a shield, or it can be towed behind a truck. This device for helping to extinguish a fire is so ingenious and valuable that the National Safety Council has taken cognizance of it.

WHY WAS IT CALLED THAT?

SLOP OIL

No knowledge of etymology is needed to guess that this term was derived straight from the familiar word used to designate a waste, refuse or impure liquid. Slop oil thus is any liquid product of petroleum which falls below a fixed standard of quality. As a rule slop oils are placed aside for redistillation.

WAR AND THE SEISMOGRAPH

Is it a fact that the invention of the magnetometer was the result of studies made by artillery officers in the World War? I heard that statement made and would like to know more about it. If it is a fact can you tell me, please, how the discovery came about?—A. T. S.

There evidently is confusion here between the magnetometer, which employs the magnetic method in prospecting, and the seismograph, which employs the seismic (or earthquake) method. It is a fact that use of the seismograph in geophysical prospecting came about as the result of studies made in the World War.

The seismograph is a delicate instrument which records sound waves and by indicating the extent and direction of sound beneath the surface points the geologists to structure that may contain oil. Practical application of the instrument in the oil industry resulted from the work of the National Research Council. One of the problems of the council was to discover or invent some means of locating long-range guns hidden far back of the enemy's lines. The council hit upon the seismograph, known most generally for recording earthquakes. This instrument registered the intensity of sound waves from artillery, and by proper calculations led the scientists to fairly accurate conclusions as to the distance of guns.

In geological explorations for oil the instrument performs a similar function with the difference that the geologist must explode his own powder to send a noise into the ground. An explosive is touched off at a certain point on the surface. The sound waves travel down into the earth. If they hit a rock structure they are deflected back to the surface. By measuring the distance the waves have traveled the geologist can locate certain structure, giving him a clue as to where he may find oil.

PROBABLE LIFE OF WELLS

Can you give any information as to the probable life of a pool from the Wilcox sands? I am particularly interested in the Carr City and the St. Louis Pools. This question is quite perplexing and one receives all kinds of answers.—H. V. B.

The foregoing question was submitted to an engineer who is recognized as an authority on this subject, and he states that it is hard to predict the probable life of wells in the Carr City and St. Louis Pools because the Wilcox sands in those areas already have produced more oil than they were expected to deliver.

The sand has been sampled by one of the companies and found to have a porosity of about 25 per cent, which is unusually high. On this basis, knowing the thickness of the sand, the probable recovery could be approximated. This is not an approved method of predicting ultimate recovery and the preferred procedure would be to plot a production decline curve from past performance of the wells.

This decline curve can only be made if all data covering production to date is made available and it is assumed that you do not have such information at your command.

Some time ago the United States Bureau of Mines, Department of Commerce, Washington, D. C., issued a preliminary report on the Seminole area. It is probable that a copy of that report would be of interest to you and it can be obtained by writing that department.

It is understood that a complete report on that area is now being prepared by the Bureau of Mines and will be ready for distribution in the near future.

REFINERY CASH ACCOUNTING

I am desirous of obtaining a textbook or treatise showing a thorough coverage of oil refinery cash accounting. Will you please advise me where to obtain such a publication?—G. D. C.

This department has no knowledge of any book dealing specifically with cash accounting for the oil refinery. The Ronald Press Co., New York, specializes in accounting publications and you might address an inquiry to that company. In The Oil and Gas Journal of October 31, 1929, page 46, you will find a helpful article, "Accounting at Petroleum Refineries," by C. E. Votrian, assistant treasurer of the Barnsdall Refineries, Inc.

The new "Gumbo Buster" Rotary —HYATT Protected

INTO their new "Gumbo Buster" Oilbath Rotary, the American Well & Prospecting Company build dependable operation, long life and Hyatt protection.

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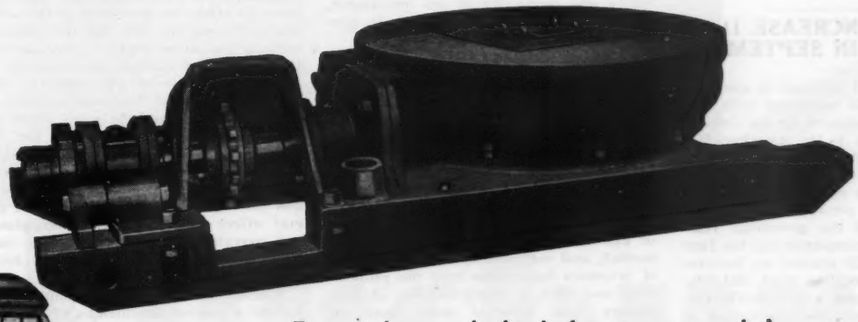

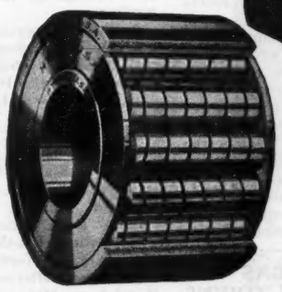

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No matter what type of oil field equipment you may need, tractors, blocks, swivels, drawworks, wagons, hoists, etc., Hyatt protection is obtainable. For Hyatt Roller Bearings, the first anti-friction bearings to be used in this service, continue to be most popular among the leading equipment builders.

Republic Supply Company who handle the "Gumbo Buster" line announce Hyatts as an outstanding feature of this new all steel rotary.

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Natural Gas Developments

TO DRILL FOR GAS TO MANUFACTURE DRY ICE

CASPER, Wyo., Nov. 30.—Drilling will be started on Farnham Dome, 12 miles east of Price, Utah, by the Carbon Dioxide & Chemical Co. to develop carbon dioxide natural gas for the manufacture of dry ice. The development will be in charge of the Fulton Petroleum Corp. of Seattle, Wash., according to the president of the company, William Fulton, Conrad, Mont., and F. Goodwin, vice president.

Utah Oil Refining Co. drilled a well on Farnham Dome seven years ago which developed an open flow of 12,000,000 feet of gas with a rock pressure of 900 pounds per square inch at 1,310 feet. This was an almost pure carbon dioxide gas and it is said an analysis shows it would have been suitable for the manufacture of dry ice.

GAS SALES INCREASE 11 PER CENT IN SEPTEMBER

An increase of 11 per cent in gas sales for September, 1929, compared with September, 1928, is indicated by the first 96 companies reporting to the American Gas Association. The customers of these companies representing approximately 80 per cent of the industry aggregated 9,560,000, an increase of 2.4 per cent over the corresponding date of the preceding year. Gas sales of these companies for the first nine months of 1929 showed an increase of 9.4 per cent, totaling near 324,000,000,000 feet compared with 296,000,000,000 feet in the corresponding period of last year.

For September, 1929, these 96 companies reported gas sales revenues of $33,900,000, an increase of 4.6 per cent over September, 1928. For the nine months the revenues of these companies aggregated $308,200,000, an increase of 4.5 per cent over the corresponding period of 1928.

The amount of by-product coke oven gas distributed by the industry continues to increase. The total amount of coke oven gas distributed by these companies during the first nine months of 1929 was over 107,000,000,000 feet or 30 per cent of the total gas distributed. During the corresponding period of last year, coke oven gas constituted 26 per cent of the total distribution of these companies.

Natural gas purchased in September amounted to 7,242,095,000 feet compared with 4,668,787,000 a year ago, an increase of 55 per cent. For the nine months natural gas purchased was 68,884,529,000 feet compared with 45,719,346,000 for the first nine months of 1928, an increase of 50.7 per cent.

All sections of the country report a very satisfactory increase in the sale of gas to industrial-commercial users. The remarkable rate of increase in the sale of gas for house heating established during the early part of the year has been maintained.

FARM FINDS 20 USES FOR GAS

A model farm in northern Illinois now uses manufactured gas in 20 different ways, according to the New England Bureau of Public Service Information: House heating, hot water, high-pressure steam, standpipe heating, garage heating, gas steam radiators, combination heater and incinerator, gas range, fireplace heater, clothes drying, incubator, forge cutting and heat treatment, soldering, laundering, heating and cooling water for stock, heating water for poultry houses, heating sprouters and germinators for seed. The owner hopes to increase the uses for gas to 40 before the end of the year.

SEES ADDED SENSE OF SECURITY IN PROPOSED MIXING OF GASES

By C. N. Glenny
Provincial Natural Gas & Fuel Co., Ltd., Bridgeburg, Ontario*

Question: What effect is the mixing of natural and manufactured gas going to have on production of natural gas and sales of same?

In the first place why should there be any amalgamation of the manufactured and natural gas interest?

The manufactured gas business might be classed as being among the oldest of the public utilities. At least for a century or more the manufacture of gas for lighting and cooking has been a business practically free from the elements of speculation or gambling. The capitalist investing his funds in the manufactured gas business could feel reasonably sure of the safety and continuity of his investment, subject of course to fluctuations in general conditions.

The natural gas business on the other hand is primarily more or less of a speculative mining proposition and even when large quantities of natural gas are obtained it often happens that it is discovered far from any practical market and then when a good market is reached there is no guarantee of continuity.

When a natural gas company has discovered an apparently abundant supply of gas and has carried it to a suitable market, and incidentally a large number of investors have come into the proposition, and then a large number of consumers have invested more sums of money in gas-using equipment and appliances, we find that the company, aside from the prospective profits which it may make, is becoming more and more obligated to do its best to insure the continuing of the fuel supply which the consumer has come to depend upon so much.

The experience of the natural gas business has almost invariably been that when the supply of gas has been abundant the price charged to the consumer has been so much lower than other fuels that waste has been the natural result and sooner or later the company has been obliged to make drastic changes in the price and the consumer has been obliged to make similar changes in his methods of consumption.

It is at this juncture, when the company has begun to realize that steps must be taken to augment the natural supply in ways other than drilling new wells, that there is a natural tendency to turn to manufactured gas as a source of relief.

Of course it is not always easy to even make this plan practical owing to the different qualities of the two gases and the difficulties of mixture, etc.

If the natural gas company has available or can lease any unexplored territory it is quite natural to expect it would be profitable to continue exploring operations on a scale which would be regulated by the supply of mixed gas and the demand of the consumer.

The most desirable consumer for a gas company is the large consumer who interferes the least with your peak load periods. In this class is found a number of industrial consumers whose installations require expensive equipment and more important a guarantee of continuity of supply.

The supplementing of the natural gas with a manufactured gas supply practically guarantees the continuity of service. This fact has a subsequent effect on the sale of gas because new uses are continually being found for gas and in most of these cases the assurance of a continuous supply is the most important factor. No less than 20,000 new uses for gas have been discovered which were not known 15 years ago.

A factor in mixing manufactured and natural gases is the lowering of the B.t.u. of the product. However if the percentage of manufactured gas used is not so large as to cause the product to get below a 900 B.t.u. point, it should not cause any material trouble in operation. Any company whose natural gas exceeds 1,000 B.t.u. is in a very fortunate position for amalgamation.

Another very favorable result of an amalgamation and which will indirectly have its effect on gas sales is the added sense of security felt by the investor, making him more ready to advance capital needed for further development.

If the employe of the company feels convinced that the business in which he is engaged is among the most stable and offers unlimited opportunities for further development he is going to make a greater effort to keep pace with the growing demands to be put upon his ability and intelligence. This will have the general effect of putting the management and carrying on the gas industry on a much higher plane. This in turn reacts on the gas-using public.

Whenever a natural gas company can foresee a general diminishing of its available supply which can not be caught up with in its new drilling operations any proposition of augmenting the natural gas supply with manufactured gas is the logical thing to do and so long as the product can be kept at a high enough B.t.u. so as not to occasion an expensive adjustment of consumers' appliances, it is bound to be of decided advantage to the investor, employe and consumer.

*Before Natural Gas and Petroleum Association of Canada at London, Ontario, October 25, 1929.

SUPPLY REFINERY GAS TO SAN JOAQUIN TOWNS

SAN FRANCISCO, Calif., Nov. 30.—A proposal to supply 28 towns in the San Joaquin Valley and northern California with a new form of natural gas was made to the State Railroad Commission by the Natural Gas Corp. of California, Ltd.

The company proposes to purchase a by-product of the oil refineries, truck it to the various towns, and there, by a process of vaporizing and carbureting, turn it into a high heat value gas. None of the towns to be supplied now has gas supplies.

The petition for a certificate of public convenience and necessity was filed by Reginald Vaughn, attorney for the Coast Counties Gas Co., a subsidiary of the Standard Oil Co. of California.

The company, which Vaughn asserts has no connection with the Standard Oil Co. of California, was organized November 15.

GAS IN BAKING EFFICIENCY

The baker of the future can sit at his desk and accurately calculate just how much gas he will have to buy each month to bake the number of loaves of bread demanded by his trade. Experts of the American Gas Association and the American Institute of Baking, while conducting research in bread baking in large improved gas ovens, were unable to account for a sizable percentage of the heat delivered into the ovens by the power gas burners. All bakers surround their bread with steam when it first enters the oven, so as to give the crust a good finish. After much study the research workers found that steam as taken from boilers is entirely too cold for baking purposes and that the gas heat which could not be accounted for was, as a matter of fact, doing useful work in making the apparently hot steam hot enough for baking purposes.

HOUSTON NATURAL GAS ADDS 10,000 CONSUMERS

HOUSTON, Tex., Nov. 30.—Nearly 10,000 new domestic and industrial consumers of natural gas were added to the lines of the Houston Natural Gas Co. and its three associated companies in the Buckner group, all of which are subsidiaries of the Houston Natural Gas Corp., during the five-month period ending November 2. This record of expansion is shown by a report just released by W. B. Trammell, general manager.

The best record for the entire period was the last week, which showed a meter setting record of 910. These companies are now rendering service to more than 17,000 accounits.

This period of rapid growth started with the summer months of this year. Meter settings for June were 1,084. The July total jumped to 1,347. The last three months, however, have shown an even heavier rate of growth. For this period of August 3 to November 2 the Houston Natural Gas Co. had a record of 4,875 meters. This company distributes throughout Houston and suburban territory.

In the same period the Gulf Cities Natural Gas Co. accounted for a net gain of 726 meters. This company distributes in Goose Creek, Baytown, Pelly, Freeport, Texas City, La Porte, Alta Loma, LaMarque, Algoa and bayshore additions.

The three-month period record of Texas Natural Gas Utilities was an increase of 1,105 meters. It operates in Victoria, Wharton, Beeville, Newgulf, El Campo, Coliad, Edna, Richmond, Alvin, Bay City, Boling, Beasley, Hungerford, Missouri City, Stafford, Ganado, Inez, Mackay, Iago, Teflerner, Pearland, Hobby, Woodsboro, Matagorda and Gulf.

The Tex-Mex Natural Gas Co. had a three-month gain of 343 meters. It operates distribution systems at Alice, Agua Dulce, Kingsville and San Diego, Tex.

UNITED GAS COMPANY FORMS OIL SUBSIDIARY

NEW YORK, Dec. 2.—Union Producing Co., oil producing subsidiary, has been organized by the United Gas Co., it is announced here. The new company will consolidate the oil production of all United Gas subsidiaries, which now aggregates 3,500 bbls. of high grade crude daily, and will operate mainly in the Pettus and Refguio County fields in Texas. Oil rights on 32,703 acres of gas leases owned by the Mission Drilling Co. and other United Gas subsidiaries will be taken over. Union Producing Co. will also control more than 150,000 acres of oil leases in other parts of Texas and Louisiana.

United Gas Co. actively stated oil expansion less than a year ago, when its total production of about 1,000 bbls. daily was incidental to its operation of several hundred gas wells. It will control about 96 per cent of the stock to be issued for the new subsidiary.

GAS LINE TO HOSPITAL

The Pittsburg, Kans., Gas Co. operating department has been busy for the past few weeks making an extension in the Pittsburg system to serve the Mount Carmel Hospital with natural gas.

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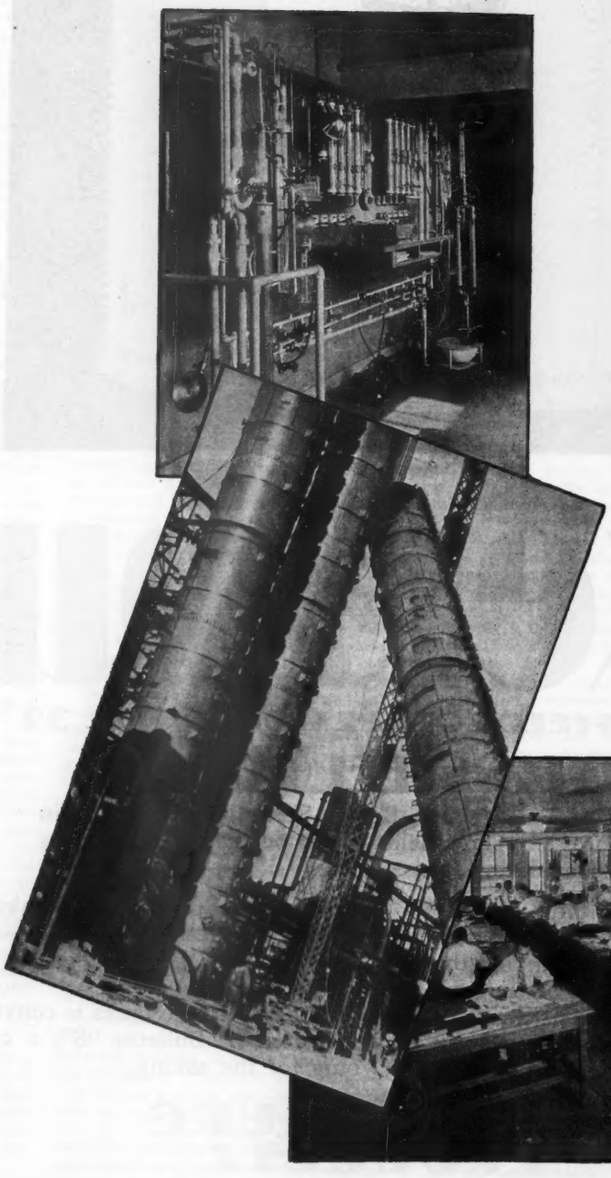

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We are, but we have the proof to back them up. Listed in this advertisement are the names of thirty leading oil companies for whom we have built equipment of importance, the jobs in some instances running into millions.

Furthermore we have back of us more than eighty years of experience in building stills, evaporators and a great variety of special equipment for other technical industries such as industrial alcohol, tar by-products, solvents, chemicals, etc.

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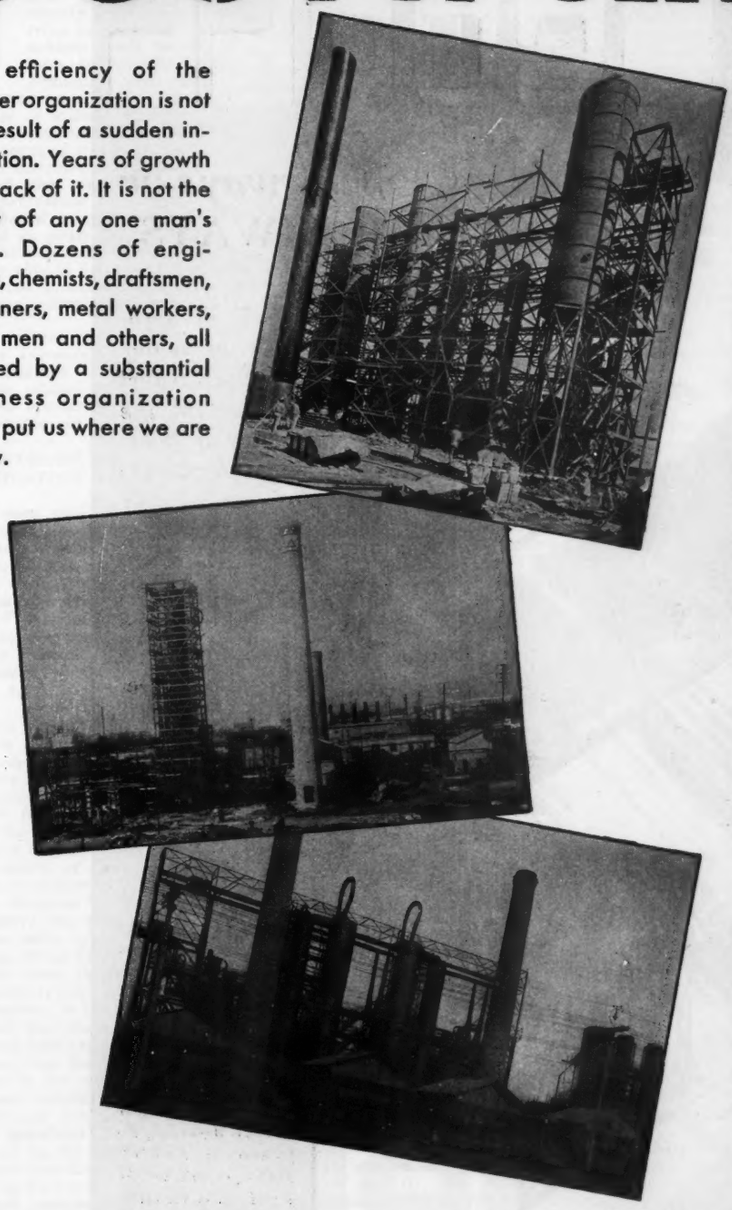

The following Companies are some of those who have purchased BADGER Equipment:

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Skelly Oil Co.
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Pierce Petroleum Corp.
Tide Water Oil Co.
Anglo-Persian Oil Co., Ltd.
Empire Refineries, Inc.
Marland Oil Co.
Vacuum Oil Co.
Associated Oil Co.
Barnsdall Corp.
Humble Oil & Refining Co.
Tidal Refining Co.
Standard Oil Co. of N. J.
General Petroleum Corp.
Beacon Oil Company
Lubrite Refining Co.
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For airways or HIGHWAYS
DRONE of aeroplane or purr of motor car . . . whether you travel thousands of feet in the sky at 100 miles an hour, or glide over highways past countrysides or through the congestion of city traffic . . . BARNSDALL refines super-fuels and lubricants to meet the particular requirements of your motor needs. Depend on the BE SQUARE for petroleum products that assure economical and dependable operation for the aviator or motorist.
Refineries: BARNSDALL, OKMULGEE, WICHITA; Sales Offices: TULSA, CHICAGO, NEW YORK, ST. LOUIS, KANSAS CITY, ST. PAUL, LOS ANGELES.
*In 1910 William Barnsdall, the father of T. N. Barnsdall, the founder of BARNSDALL, established the world's first oil refinery.

BE SQUARE TO YOUR MOTOR

Technical Questions Answered

BY CHARLES K. FRANCIS, PH.D., TECHNICAL EDITOR

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with the marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible so as to assure a satisfactory answer.

All inquiries should be signed and if other than the given initials are to be used please indicate the desired letters.

Questions involving patented processes, intricate formulas and calculations and estimates of costs, for obvious reasons, cannot be answered. The replies will appear on this page within a reasonable time.

EMULSIONS-CRUDE OIL AND LUBRICATING OIL

I have done some work on oil water emulsions but have been unable to produce a satisfactory emulsion for experimental purposes. Where could I obtain some emulsified oil? What causes this kind of emulsion and what is the best way to break it? Is emulsified lubricating oil caused by the same kind of action as it is with crude oil? Have you a list of the literature of this subject?—S. P. and R. S. L.

The authorities agree that the emulsions met with in the petroleum industry are caused by some impurity which may enter the mixture through water or the oil itself. Emulsions are found quite commonly in all fields where water is produced with the oil. Bancroft states in Applied Colloid Chemistry, page 261: An emulsion consists of drops of one liquid suspended in another liquid. When these drops are stabilized by an electric charge, they behave like other colloidal solutions of the same type. In most cases there is an actual film around the globules and this keeps them from coalescing. The necessary condition for forming a stable emulsion is that the drops shall be so small that there shall be a sufficiently viscous film around each drop to keep the drops from coalescing.

The impurities in the water occurring in an oil well may include calcium, magnesium, sodium and other salts and resins. Similar impurities may be found in lubricating oil as the result of the chemical treatment and the washing with impure water. In both cases the film of oil around a salt particle tends to the formation of a mineral soap when there is sufficient agitation of the mixture and these globules scattered throughout the mass are difficult to separate.

When a mixture of pure and fully refined lubricating oil and distilled water is vigorously agitated, an emulsion will result, but, the two liquids will separate very quickly. In fact, a test of this character is frequently used to determine the purity of a lubricating oil because when the lubricating oil contains alkaline substances, possibly organic matter and resins, there will not be a rapid separation. In other words, the degree to which an oil will emulsify is, in most cases, a measure of its purity.

It is the mechanical agitation of the mixture of oil and water, producing extensive difference of the drops of water which is responsible for the formation of a stable emulsion. So long as the drops of water remain large there will be no permanent emulsion, but when the drops are very small, some of them microscopic, they become coated with the film of mineral matter which aids in keeping them in suspension. There is one form of emulsion that is frequently met with in the field and that is where oil and gas are emulsified at the face of the producing sand in the presence of small quantities of pure water. Such emulsions are very temporary and a separation is effected on short standing in the storage tank.

There are a number of different methods for treating emulsified oil. Briefly, these include settling with or without the aid of heat; sometimes water is added to aid the separation, chemical processes in which some sort of chemical is added to the emulsified oil; the electrolytic process in which advantage is taken of the fact that small drops of water become electrically charged so that the film is broken without formation of larger drops and these fall to the bottom. There is also the centrifugal process which makes use of centrifugal force on the same principle that is used in cream separators.

Under some conditions a modified form of distillation is practiced and by this method some of the lighter products and the water may be removed by heat.

The United States Bureau of Mines has studied emulsified oils and a complete discussion of the subject may be found in Bureau of Mines Bulletin 250 by D. B. Dow, Oil Field Emulsions. This bulletin may be obtained from the Superintendent of Documents, Washington, D. C., for 25 cents. It contains a selected bibliography of articles on the subject.

VOLUME AND WEIGHT OF GAS

What is the explanation for the volume weight of any gas being 379 cubic feet at ordinary temperature? How is this number of cubic feet determined from the analysis of the gas?—R.K.G.

This is a reference to the molecular volume of any gas, when expressed in pounds, being equivalent to 379 cubic feet when the temperature is 60° F. and the pressure is normal, that is one atmosphere. There are several fundamental laws involved but space will not permit a complete discussion of them; however, the subject may be outlined with sufficient detail to explain the origin of this convenient and valuable constant.

The combination of the atomic weights of the several elements present in a compound gives a sum which is known as the molecular weight of the special substance. The atomic weight of carbon is 12, and that of hydrogen is one, and these elements are for convenience represented by C and H. The molecular weight of methane, CH_4, is 16; ethane, C_2H_6, is 30; propane, C_3H_8, is 44. Knowing the composition of any substance the molecular weight may be obtained. The numbers used may be in any unit of weight, but in scientific work the gram is the standard and all industrial measurements of gas are made in the United States in terms of cubic feet and weights are commonly expressed in pounds. If the molecular weight is stated in grams then the volume should be in liters, and such weights are called mols, or gram mol. When the molecular weight is stated in pounds then the volume of gas is in cubic feet, and the weight may be called a pound mol.

When making scientific calculations concerning gas volume it is the practice to reduce the volumes to what are known as standard conditions, and these are 0° Centigrade and 760 mm. pressure. Under these conditions the volume of a pound mol is 359 cubic feet, and this calculated to 60° F. becomes 379 cubic feet.

The composition of a mixed gas may be set up as percentage, volume weight, and molecular volume. The composition of air is approximately 20 per cent oxygen and 80 per cent nitrogen, and in 100 volumes there would be the same ratio of molecules; also the mol per cent would be the same. The molecular weight of carbon dioxide, CO_2 is (12+32) 48, and 48 pounds would have a volume of 379 cubic feet at 60° F. Sixteen pounds of methane, 30 pounds of ethane, and 44 pounds of propane would have the same volume under the same conditions of temperature and one atmosphere of pressure.

All that is necessary when the volumetric percentage of a gas mixture is known is to convert to mol percentage the volume of each constituent and the sum of these will give the weight of 379 cubic feet of gas in pounds at 60° F. at atmospheric pressure.

PETROLEUM COKE COMPOSITION

What is the composition, fuel analysis, of petroleum coke? What oils are used for making this coke? Does the coke vary in composition or quality with the oil used?—H. R. A.

The composition of petroleum coke may vary with the kind of oil run and the process itself. While a few plants may run some coke stills, the greater part of the coke made now is the residue obtained as a byproduct. The analysis following represent the product obtained in a pressure still from clean gas oil; that derived from reducing a high grade crude; and the coke obtained from a heavy residue in a tube still cracking unit.

Substance—	Pressure still gas oil charge per cent	Crude oil per cent	Tube still cracking per cent
Moisture	0.40	0.80	5.12
Fixed carbon ...	92.53	88.94	80.44
Volatile matter..	6.30	9.46	13.38
Ash	0.72	0.80	1.06
Sulphur	0.60	1.26	1.28
B.t.u. per pound	15,019	15,000	14,520

Petroleum coke is characterized by a high carbon content, low ash, and low moisture content. The moisture shown in the third sample above is due to the use of quenching water.

GUM AND COLOR IN GASOLINE

Is it known what steps in refining are responsible for the large quantity of poor color and high gum content gasoline which is now on the market? How can gum be treated out of gasoline?—L. S. A.

It appears that gum forming bodies are derived from either certain unsaturated hydrocarbons of the paraffin series or from aromatic groups. The compounds that tend to produce a knockless gasoline seem to be closely related to those that produce color and gum; because, in most instances the gasoline which is free from color and gum is a product with a low knock rating. The source of the petroleum and the method of manufacture have much to do with the presence of these substances and the possible formation during the refining process. Some crude oils contain substances which cause the gasoline to be off color and to contain large quantities of gum forming compounds. The cracking operation, especially the vapor phase type, causes the formation of substances which are high in color and also gum. It is the problem of the refiner to eliminate the objectionable products and to retain the desirable ones.

The common practice is to eliminate gum by special forms of heat treatment and quite carefully controlled chemical processes in treating the product. Attention should be called to the fact that actual and potential gum should be recognized. Frequently a gasoline will go off color and the quantity of gum will increase during storage, so the gum content of a gasoline that is comparatively new cannot give an indication of what may be expected after several weeks or months.

Much has been written about the gum content of gasoline but most of the discussion has had to do with the methods for determining it. Unfortunately we have no method for determining gum in gasoline which is acceptable to all who have studied the subject. The final test is that of actual performance in the motor. Surveys have indicated that the quality of gasoline is constantly improving as to color, gum content, and general performance.

ANTIFREEZING SOLUTIONS

What are the specifications for the products which may be used for making antifreezing solutions for automobile radiators? I would like to have a list of the various chemicals and liquids that are used for this purpose together with the freezing points for each on a percentage basis?—T. H.

The important essential for any substance that is to be used for lowering the freezing point of water is that it will be soluble in water to a large extent. It must not be corrosive, or tend to form a corrosive substance, nor act on the metal parts and rubber connections. Substances for this use should not produce unpleasant odors and should be obtainable in all parts of the country at a low cost.

Solutions of common salt, calcium chloride, and magnesium salts were formerly used for antifreeze purposes but all of them cause serious corrosion so they are seldom found on the market now. Some of the distillates from petroleum, such as unfinished kerosene, have been used in automobile radiators but they are not safe because of the fire hazard and the fact that they soften the rubber connections.

The alcohols and the related compounds have become very popular for making antifreezing solutions. Mixtures containing either methyl or ethyl alcohol (denatured alcohol) give good results but care must be observed not to permit the solution to come in contact with the automobile finish; these substances are solvents for paints and varnish. Glycerin makes a good material but it is not easy to obtain and the cost is somewhat high. Ethylene glycol, a compound closely related to both ethyl alcohol and glycerin, possesses properties which make it valuable as an antifreezing compound. It does not evaporate at low temperatures, does not corrode, is free from odor, and lasts with care for a long time.

The Fahrenheit freezing points of water solutions of the most important of these substances is shown in the table following:

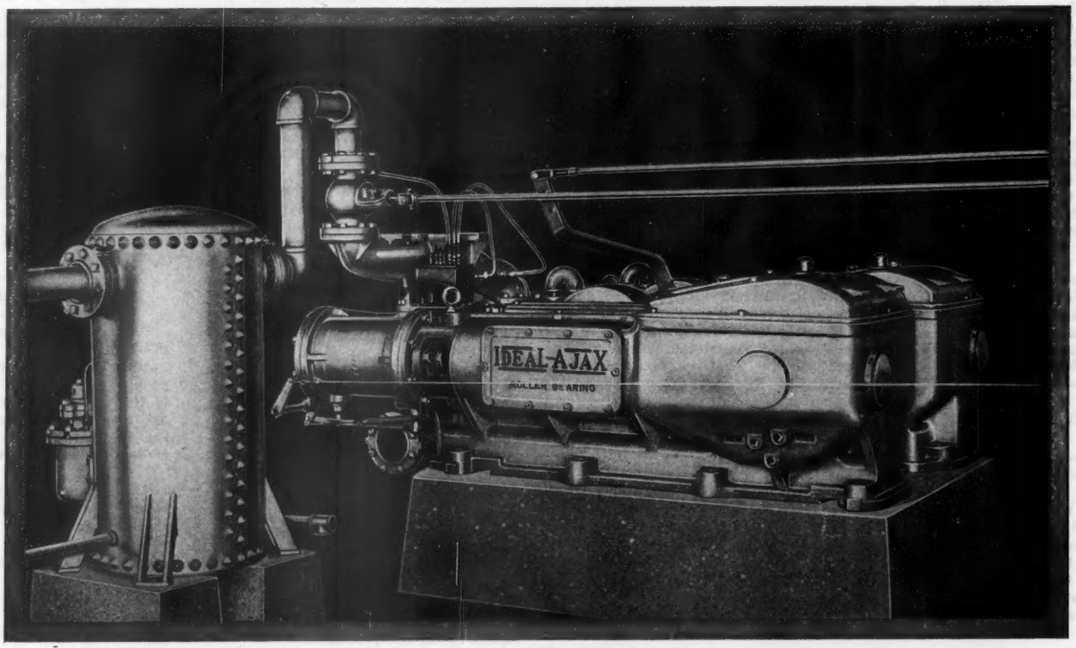
Per cent volume	Glycerin	Ethylene glycol	Ethyl alcohol
10	+29	+27	+25
20	21	17	17
30	12	3	5
40	0	—14	— 8
50	—15	—34	—24

Preparations of calcium chloride, containing small quantities of chromates which tend to inhibit corrosion of some metals, have been offered as antifreeze agents but such compounds attack aluminum so the alcohols, glycerin and ethyl alcohol mixtures are to be preferred.

The New IDEAL-AJAX

12x12 Twin Roller Bearing Engine

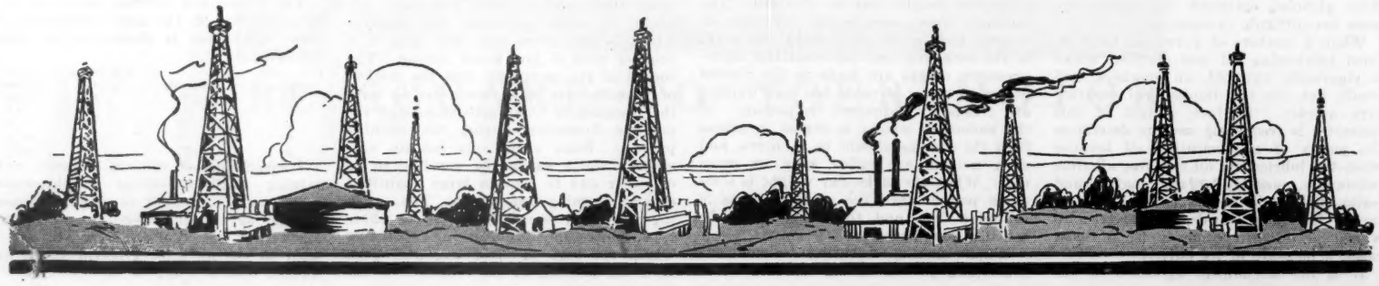
With Piston Valves, Large Capacity Steam Separator* and Trap, Locomotive Type Drain Valves, Relief Cocks, and Three Feed McCord Lubricator.



The New Ideal-Ajax shows advancement in steam drilling engine design, material and workmanship equal to the advancement in automobile design and construction.

Ideal-Ajax was the first engine to adopt roller bearings. It was the first piston valve engine. And now comes a large capacity steam separator with automatic Trap; locomotive type drain cocks operated from the derrick to further speed up drilling.

*This new large capacity steam separator with automatic trap can be hooked up with old Ideal-Ajax equipment to increase efficiency, economy and speed of your present outfit.



Dominates the Field

AJAX

STEAM DRILLING ENGINES

are now in use in every big drilling field in the world. Illustration herewith shows an Ideal-Ajax 12x12 Twin Roller Bearing Engine in operation at Maud, Okla.

Wherever you go, a National Supply Man can tell you about the performance of Ideal-Ajax equipment. The stories of some of the new Ideal-Ajax Roller Bearing Engine performance are astonishing.

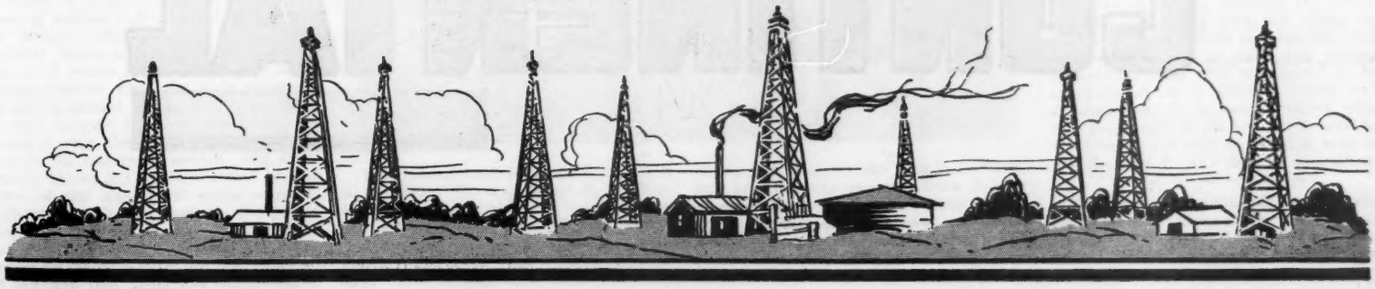
Made by AJAX IRON WORKS, Corry, Pa.

DISTRIBUTED BY

THE NATIONAL SUPPLY COMPANIES

NSCO

in every oil field



SERVICE REPORTS SHOW THAT

D+B HEATREAT SUCKER RODS

GIVE LONGER SERVICE

Special "Heatreating" of D & B Sucker Rods gives them the ability to stand vibration and abuse so well that they give the maximum of service.

"If Continental Sells It . . . . There Is No Better"

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THE CONTINENTAL SUPPLY CO., Ltd.

224 Traders Building, Calgary, Alberta, Canada

J670

CONTINENTAL

EQUIPMENT AND SUPPLIES

SOTCO TOOL PERFORMS SERIOUS FISHING JOBS

The Sotco hydraulic knuckle, or dog-leg, made by the Specialty Tool Co., Los Angeles, Calif., is a massively constructed hinged connection for rotary drill pipe, operated by hydraulic pressure and affording positive circulation regardless of the angle at which the tool is being used. It has performed serious fishing jobs and can be employed in conjunction with any fishing tool in fishing for pipe lost in big holes or cave-ins.

The hydraulic knuckle is screwed onto the drill pipe with the required fishing tool attached to the lower hinged section. The string is then lowered to the proper elevation to engnge the twistoff, and the mud pump started. Simultaneously the drill pipe is slowly rotated until the "fish" is contacted, after which, if an overshot, rocket or tap is being used, the drill pipe is raised slowly, maintaining the contact, and lowered onto the "fish." If a hook is being employed, the twist-off will become engaged as the hook is brought up under the upper coupling or tool joint.

The mechanical design of the hydraulic knuckle is said to assure maximum strength per pound of metal used. No weight is exerted on the hinge-pin. The entire pulling weight is supported by the weight pins, consisting of four arc-shaped heavy chrome vanadium steel segments set into holes at each side of the lower hinged section and welded rigidly in place. These weight pins slide within arc grooves planed into the flat sides of the top section. Two additional arc grooves are milled into the top section a short distance below the weight pin grooves for the purpose of accommodating the stop pins.

The stop pins, made of chrome vanadium steel, are screwed rigidly into the lower hinged section, their inner ends extending into the stop grooves, thus limiting the hinge movement to the proper degree of radial travel. Two grooves are formed into the upper part of the top section, extending upward above and parallel with the flat surfaces, within which the upper side wall ends of the lower hinged section are snugly housed at all positions. This groove locking effect prevents side spread in the lower hinged section, and retains the weight pins in positive position within their arc slides.

AUXILIARY LIGHT PLANT

To meet a growing demand for a source of power to supply illumination for night work, Fairbanks-Morse & Co., Chicago, have developed a compact selfcontained light plant of simple design. It generally is not feasible to operate a lighting generator from the main power unit because of the extreme speed variations due to radical load fluctuations which occur on this unit and cause violent voltage fluctuations which in turn of course produce a flicker in the light. An independent lighting unit provides a steady candlepower and is available for use when the main power plant is not in operation.

There is a growing tendency on the part of isolated industrial plants as well as isolated office building and similar lighting plants to provide an economical source of power for light electrical loads during periods when the main generator is not or should not be operating. Such a unit is used to advantage to supply lights during the nonworking hours as well as for emergency service. The Fairbanks, Morse & Co. plant comes in two sizes of 750 and 1,500 watts capacity respectively. In the assembly the power unit, the ignition system, the generator and the control mechanism are maintained as separate units not being tied up in any way that introduces complication.

ALLSHUL PHILADELPHIA MANAGER FOR RYERSON

Arthur C. Allshul, formerly manager of the Buffalo plant of Joseph T. Ryerson & Son, Inc., has been appointed manager of the company's new unit in

Arthur C. Allshul

the Philadelphia district. As previously announced, the Ryerson company has purchased the business, equipment and good will of the Penn-Jersey Steel in Camden, N. J., and is making other arrangements to provide for a comprehensive stock to meet the requirements of the trade in the Philadelphia metropolitan district.

Clarence S. Gedney has been appointed manager of the Buffalo plant, succeeding Mr. Allshul. Mr. Gedney has been connected for years with the specialty sales division of the Ryerson business in the Chicago territory.

A bulletin issued by the Standard Conveyor Co., North St. Paul, Minn., shows photographs of various institutions using the company's carrying devices.

TWO PIPE MACHINERY COMPANIES COMBINED

A merger has been effected by the Oster Manufacturing Co. of Cleveland, Ohio, and the Williams Tool Corp. of Erie, Pa. This brings together two representative lines of pipe machinery. Oster produces and markets adjustable pipe-threading tools, the Power Boy portable pipe machine, and belt and motor driven pipe machines from one-fourth inch up to 8-inch. Williams manufactures standard and "rapiduction" pipe machines from one-fourth inch to 18-inch, pipe cutting-off machinery and both single and double spindle bolt machines.

The Oster Manufacturing Co. was founded in 1893 by Herman W. Oster and Russell B. Tewksbury. Its officers are R. B. Tewksbury, president; Roger Tewksbury, vice president and treasurer; Arthur S. Gould, secretary. It maintains a factory in Cleveland and has sales offices in principal cities in this country as well as in London, Osaka, Sydney, Buenos Aires, Arnhem, Stockholm and Shanghai.

The Williams Tool Corp. was founded in 1901. Its officers were Horace W. Davis, president; E. P. Poole, vice president; J. E. Humble, secretary and treasurer. Through the merger, Mr. Davis has been succeeded as president by Roger Tewksbury. The Williams company has plants in Erie, Pa., and Brantford, Ont.

BUSINESS NOTES

Clark L. Jenkins has joined the sales force of the Camp-Morgan Co., Fort Worth, Tex. He had a wide acquaintance in the Mid-Continent territory.

The Campbell Engineering Co., Short Hills, N. J., manufacturer of the Campbell steam flow controller for oil stills, drainage controls for high pressure steam, pump discharge and fluid-level controls, and the Tar Baby oil burner, announces that the following concerns, recently appointed, are the only ones now representing the Campbell company: George B. Allan & Co., Tulsa; George B. Allan & Co., Dallas, Tex.; L. E. Pollard, Pittsburgh, Pa., and Smiley Equipment Co., Kansas City, Mo.

EXPERIMENTS PRODUCE NEW BI-METAL BEARING

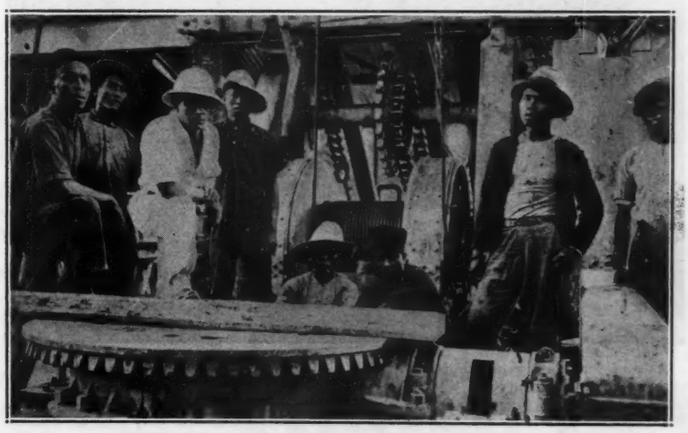
Seeking primarily to produce a satisfactory bearing metal at a lower cost, engineers of the Fredericksen Co., manufacturers of bearing metal in Saginaw, Mich., have developed a new type of bi-metal bearing. The company, for a number of years, has been manufacturing a bearing bronze sold under the trade name of "Sabeco." This product is composed of virgin copper, tin and lead, with a high percentage of lead alloyed by a secret process which prevents segregation of the lead as well as seizing, scoring, burning, corrosion, pounding out, and other evils. Sabeco is said to possess long life and a low coefficient of friction and to require less lubrication than is usual. Cost of manufacture precluded its use in many instances.

Experiments have resulted in the new bearing material, which is to be known as "Sabeco-ed steel bearings." The new bearing metal consists of an outer shell of seamless steel tubing to which an inner lining of Sabeco bearing bronze is inseparably fused. Tests of the fusion of the metals have been made by bringing the entire bearing to the melting point of the bronze, allowing it to run out. Examination after cooling showed a film of the bronze adhering to the steel, clear evidence of the welding of the two metals. Further evidences of this fusion is shown in machining, there being no separation of the metals in the chips.

The process of manufacture was developed after numerous experiments, the bearing metal being deposited on the steel shell by centrifugal force while the temperature of both metals is at the melting point of the former. This process, in addition to bringing about perfect fusion of the two materials, produces a uniform inner shell of the bearing material, which is reamed to the desired size. Greater strength and longer wear are advantages said to have been gained by the new process.

At present the construction cannot be practically applied to bearings with very thin walls; the minimum wall thickness in which it can be used is about one-eighth inch. The new material can be furnished, however, in lengths up to many feet, thus effecting an important economy in production work as pieces to the exact size required may be cut off with minimum waste.

SOMETHING DIFFERENT IN DRILLING CREW PERSONNEL



This enlargement of a snapshot taken in southeast Borneo, shows J. A. Willems, driller, and his crew, whose names are not provided. Mr. Willems wasn't just starting out on an exploring expedition. That's the way he dresses every day. His drilling crew might feel sort of out of place in the Seminole Field, but according to reports, these fellows soon mastered the rotary drilling outfit, which in this case happened to be an Emsco all-steel roller-bearing rotary machine and an Emsco Type RR three-speed roller-bearing draw works.

MUDWATE HELPS SOLVE TROUBLE IN DRILLING

Mudwate, a heavy drilling mud made by the American Mining & Chemical Co., Shreveport, La., is said by the manufacturers to be a scientifically correct product designed to meet the needs of oil and gas producers. The specific gravity of Mudwate is approximately 400 per cent greater than that of average slush. It enables the operator to keep a well under control where high pressures are encountered while drilling.

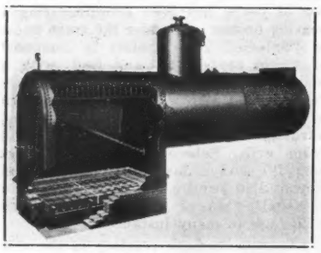
The smooth mixture produced lubricates the drill-stem, enabling the driller to make more hole with less strain on equipment. Its weight and texture tend to prevent caving in shale and similar formations. This mud is reported to be acid-resisting to a marked degree and anticorrosive. It is readily mixed with and suspended in oil for use in pulling stuck casing. It may be added to mud in the slush-pit in any desired proportion.

The Headley Emulsified Products Co. on October 1 became the successor to Headley Good Roads Co. of Philadelphia, which for 21 years has manufactured emulsified asphalt products.

EQUIPMENT AND SUPPLIES

OIL WELL ANNOUNCES A HIGH-PRESSURE BOILER

The Oil Well Supply Co., Pittsburgh, Pa., announces a new "Oilwell" 350-pound working pressure boiler for use in deep drilling and for extreme service. New features and improvements have



been incorporated, the manufacturers say, to meet the demand for high pressures with safety.

An 84-inch open-bottom type firebox with a solid forged steel mudring, equipped with a Nicholson thermic siphon, promotes improved service at a low operating cost. The siphon adds 20 per cent more heating surface to the firebox and increases the water circulation. This action produces steam easily and rapidly and increases the capacity of the boiler with a reduction in fuel consumption. The siphon also acts as a rigid support to the crownsheet.

The 2¼-inch copper-bearing steel seamless boiler tubes are set in copper ferrules, beaded and prossered in the firebox tube sheet, providing 15 to 35 per cent greater heat transmission, depending on the pressure of the flue gas. The tubes are arranged in vertical and horizontal rows providing a self-cleaning effect.

The shell butt straps are of the saw tooth type giving efficiency and strength to the joint with the least possible weight. Washout plugs are conveniently located in the smokebox flue sheet for the purpose of washing off the bank of flues from several positions. Handhole and manhole plates and all fittings are forged steel and of the marine type.

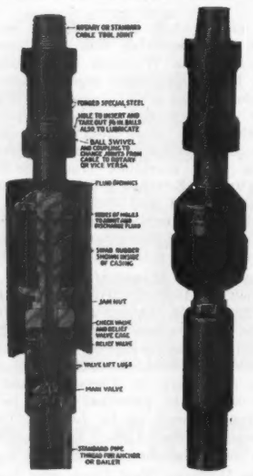
HEENEY AS VENEZUELA AGENT

P. H. Heeney, well known in South America and Mexico as an oil field construction expert, has completed arrangements to act as field representative in Venezuela for the Columbian Steel Tank Co. of Kansas City. Mr. Heeney has been in Venezuela for three years and previous to that time, was in the oil field construction business 17 years in Mexico. Twenty American oil companies are reported to be preparing to enter the Venezuelan field within the next few months. New government highways totalling more than 400 miles of paved roads which will be opened next April are expected to give impetus to the demand for oil marketing equipment.

YOUNG DOUBLES FACILITIES

Production of industrial type internal combustion engine cooling radiators for trucks, power units, compressors, industrial machinery, hot-water forced draft automobile heaters, and new type forced draft heating units for factories and buildings reached its peak in the history of the Young Radiator Co., Racine, Wis., and F. M. Young, president, reports plans under way to double the company's manufacturing facilities during the coming year. Increase in accounting, purchasing and engineering department personnel has also been made to take care of the additional work.

KIBELE PRODUCTION SWAB



The above illustration of the Kibele production swab, distributed by the Lucey Products Corp., shows its construction in detail. This swab, designed especially for heavy loads, is so constructed that the fluid pressure works with it, not against it. A relief valve unloads at any given pressure, insuring against plugging a well if sent to the bottom, the manufacturers say.

TRADE LITERATURE RECEIVED

A bulletin describing the use of tube-turns in the new power plant of the Bureau of Standards, Washington, D. C., has been prepared by Tube-Turns, Inc., Louisville, Ky. Tube-turns, forged from seamless-drawn tubing in the form of 180° returns, are stock fittings for welded coils, piping and connections of all kinds.

"Studies in Structural Arc Welding," issued by the Lincoln Electric Co., Cleveland, Ohio, comprises eight leaflets, each one devoted to some use of the arc weld in structural work.

"Cleaning a 72,000-Bbl. Tanker" is among articles that appear in the current issue of Oakite News Service, published by Oakite Products, Inc., New York.

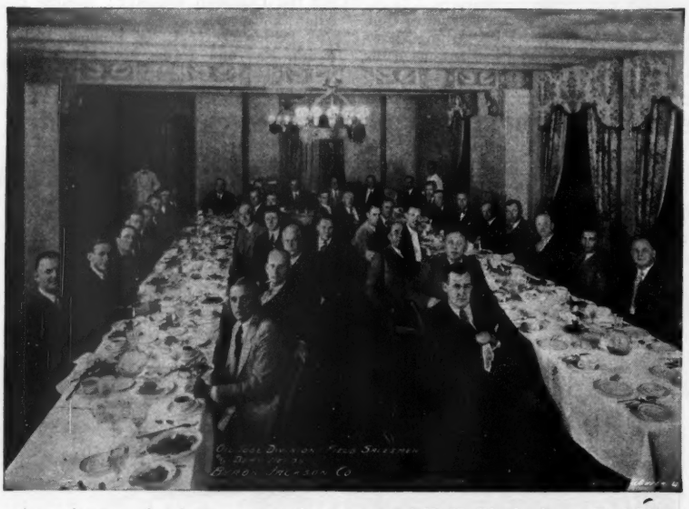
Two bulletins are being mailed by the Mine Safety Appliances Co., Pittsburgh, Pa., one describing the F-M continuous flammable vapor regulator and one describing the McCaa Oxygen breathing apparatus, half-hour type.

The Hills-McCanna Co., Chicago, has prepared a bulletin devoted chiefly to the Young tank car bottom outlet valve, the triple-seal piston design of which is said to prevent all leakage.

NEW MacCLATCHIE CATALOG

A new 36-page catalog of the MacClatchie Manufacturing Co., maker of oil field specialities, Compton, Calif., is much larger than the one it replaces, and contains data on all the specialities manufactured and distributed by MacClatchie. With a heavy cover, in three colors, the booklet is loose-leaf, and made up of four pages on each of the MacClatchie tools. Each speciality is shown in one or more action pictures taken in the field, and also in close-up detailed photographs. Included in the catalog are the new geared brake for draw-works, flow nipple, valves, the cementing combination, made up of cement-head, stop cocks and quick unions, valve-seat puller, pump-liner puller, rotary underreamer, and automatic safety cathead. Other leaflets will be sent from time to time to those receiving the catalog.

BYRON JACKSON REPRESENTATIVES HOLD CONFERENCE

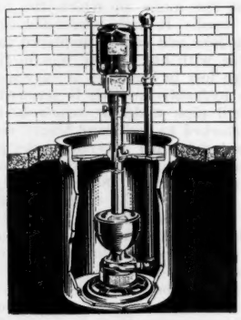


A conference of sales representatives of the Byron Jackson Co., oil tool division, held in Los Angeles, Calif., from November 4 to 12 inclusive, was attended by every member of the force in the Mid-Continent and Pacific Coast district except J. S. Mellon, who was ill, and "Bud" Vincent, who was left to hold the fort in the Mid-Continent. Salesmen present were:

A. E. Raine (in charge of Mid-Continent sales), R. T. Todd, B. B. Thompson and E. H. Blankenburg; Earl Hagy, Houston; L. M. Deutsch, Fort Worth; Marshall Moore, Troy McMillan and R. M. Cook, Oklahoma City; L. E. Vaughn (sales manager,) E. E. Hampton, G. W. Moore, Clyde Bell, J. B. Nelson, H. W. Driggs and R. H. Funk, Los Angeles; F. E. Weland, Long Beach; E. W. Forrow and Gene Suttton, Santa Fe Springs; G. W. Wiggett, Ventura; George Calder, Kettleman Hills; J. W. Keating, Bakersfield.

PUMP PREVENTS MENACE OF ACCUMULATED WATER

There are numerous places where water accumulates by seepage, overflow, flood or backing up, that cannot be drained off directly, either because the flow line of the sewer is not deep enough



Electric Sump Pump With Cover

or because obstacles intervene between the sump and the sewer.

Among the more common instances may be mentioned cellars where no sewers exist, or where the sewer line is above the basement floor level or deep cellars of buildings, boiler rooms, settling basins, fly wheel and elevator sumps, tunnels, scale pits, etc. While ordinarily this seepage may amount to only a small trickle, its flow is continuous and if neglected the accumulated water soon becomes a menace to health and property.

To keep such places dry the incoming water may be disposed of as it accumulates with an automatic cellar-drainer (water or steam operated) or an automatic electric sump pump. Both units, manufactured by the Penberthy Injector Co., Detroit, Mich., are designed for the same class of work. The electrically operated pump, however, has a much greater capacity than the water or steam operated drainer. Local conditions will determine which type is preferable. Both are constructed entirely of copper and bronze.

VAPOR CONTROL EQUIPMENT

Designed for the fabricating and manufacturing of new vapor control equipment, the factory of Vapor Recovery Systems Co. has just been completed in Compton, Calif. It is equipped with special machinery for the production of gauge and thief hole covers, vent valves, flame arresters, safety vent valves, explosion relief valves, vapor recovery regulators, automatic tank gauges and complete swing line equipment. According to Frank V. Long, president, construction of this plant became necessary for the manufacture of a complete line of tank equipment embodying special features found to be desirable after designing and operating approximately 200 vapor recovery systems.

MOTORS RUN QUIETLY

The General Electric Co. announces a line of single phase, squirrel cage capacitor motors, designated type KC, especially designed for quiet operation. These motors are expected to find their principal application driving blowers and ventilating fans in buildings, on low torque centrifugal machinery, on low pressure pumping applications, on some wood working machines and machine tools where the motor is built into the machine, etc.

Unretouched reproduction of cores taken in the Prairie Oil & Gas Company's Hellman No. 1 Well at Belvedere Gardens, California. Drilled by Little & Bell, drilling contractors.

Uniformly good-

Here is concrete evidence of the efficiency and value of the H. C. Smith Type "C" Coring Outfit in oil well drilling operations.

The exact record of the recovery in this well is as follows:

Of the total of 247 cores taken—
32% were 100% Perfect Recovery
28% were 75%-100% Perfect Recovery
19% were 50%-75% Perfect Recovery
21% were 50% or less Perfect Recovery
Average—72.05% Perfect Recovery

H. C. Smith *Efficiency* Products

- H. C. Smith Type "C" Drilling Bit with Roller Reamer Body.
- H. C. Smith Type "F" Rock Core Bit Head.
- H. C. Smith Type "C" Coring Outfit.
- H. C. Smith Type "CI" Underreamer.
- H. C. Smith Draw Works Brake Attachment.

Catalogs on request.

H. C. SMITH MANUFACTURING CO,. *Inc.*
Los Nietos, California
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Oil Well Supply Co., Exclusive Sales Distributors, Outside of California, for H. C. Smith Coring Equipment and Demountable Drilling Bits.

H.C. SMITH *type "C"* CORING OUTFIT

Aluminum as Corrosion Resistant

Use of Aluminum Alloys in the Oil Industry Has Shown Remarkable Increase. Probable Extension of Its Uses

By Stanley Gill
Research Department, Gulf Oil Cos.*

The use of aluminum and aluminum alloys in the oil industry has shown a remarkable increase within recent years. A great impetus to this increase has been given by the development of numerous fields producing oils of high sulphur content. Hydrogen sulphide is a corrosive agent of great destructiveness and aluminum is, generally speaking, quite resistant to its action. The possibility of obtaining in aluminum or its alloys materials of light weight, great strength and high resistance to corrosion makes them applicable under a wide variety of conditions. The purpose of this paper is to present briefly the present status of the use of aluminum in the oil industry and to indicate, necessarily somewhat vaguely, the lines which will probably be followed in the extension of its use.

Aluminum and Aluminum Alloys

The commercially available aluminum alloys cover a wide range of composition and of physical properties. They range from high purity aluminum, which contains not less than 99.4 per cent aluminum, through a series of alloys containing greater or lesser proportions of various alloying elements. These alloys may, by appropriate heat treatment, be given physical properties covering a very wide range. Alloys possessing almost any desired combination of physical properties can be obtained in either cast or wrought form.

The differences in composition and in heat treatment which are needed in order to fit the physical properties to the requirements of various applications have considerable influence upon the relative corrosion resistance of the various alloys. Generally speaking, it cannot be stated just what alloy will possess the greatest corrosion resistance under any set of conditions, and it is usually necessary to test a series of alloys of proper physical characteristices in actual service before any conclusion can be reached on this point.

Certain general principles apply to the corrosion resistance of aluminum and of aluminum alloys. Aluminum is a highly electronegative metal which owes its corrosion resistance to an oxide film. Conditions which will result in the destruction of this oxide film will deprive aluminum of its corrosion resistance. Thus, aluminum and aluminum alloys are not resistant to strong alkalies. They are also destroyed by most strong mineral acids. Chlorides are, in general, quite destructive to aluminum and the aluminum alloys, although there are some conditions under which aluminum will stand up well in chloride solutions. Oxygen-free solutions, especially if they contain any considerable amount of chloride, corrode aluminum quite rapidly. Aluminum is also particularly susceptible to pitting action under conditions which result in the formation of oxygen concentration cells. Thus the presence of large quantities of dirt may result in corrosion of aluminum in a medium which would otherwise not affect it. Because of its electro-negative character, aluminum will undergo rapid corrosion when it is in electrical contact with other metals, or with materials such as iron sulphide, in a strongly corrosive medium. On the other hand, colloidal material in the corrosive medium will sometimes inhibit corrosion of aluminum, as will also soluble silicates which are almost always present to some extent in oil field brines. This may account for the resistance of aluminum to such brines.

Resistance to Corrosion

Much experience has shown that all of the commercial aluminum alloys possess a remarkable resistance to corrosion by gases or air containing high concentrations of hydrogen sulphide at temperatures below 250 degrees Fahrenheit. For application under such conditions it may be quite positively stated that aluminum will give satisfactory service.

Aluminum and its alloys should not be considered for service at high temperatures. The melting points of these alloys are relatively low, falling between 1,000 degrees and 1,200 degrees Fahrenheit. Below these temperatures they show a great tendency to creep under load. The strong alloys of aluminum owe their remarkable physical properties to heat treatment; if held for any great length of time at an elevated temperature, they will lose much of their strength. For these reasons, aluminum alloys should scarcely be considered for use at temperatures above 250 degrees or 350 degrees Fahrenheit, and their greatest range of applicability lies at temperatures below 200 degrees Fahrenheit.

Use of Aluminum in Oil Well Equipment

Generally speaking, aluminum and aluminum alloys are entirely inapplicable for the construction of oil well equipment. This is in part due to their electro-negative character, since the greater part of the material used in equipping oil wells must necessarily be of iron or steel which are electro-positive with respect to aluminum. A far more important reason lies in the fact that aluminum and its alloys are not resistant to corrosion under the conditions usually encountered in oil wells. Normal oil field brines are oxygen free and contain large amounts of chloride, a combination which is extremely destructive to aluminum. In a series of tests of aluminum and various strong aluminum alloys in oil wells in Texas Gulf Coastal fields, these alloys had only one-half the life of ordinary steel or wrought iron pipe.

Aluminum tubing has been used with considerable success in the production of sulphur. The tubing used in sulphur wells is subject to extremely severe corrosive conditions, since it is exposed to water of fairly high salt content, molten sulphur, hydrogen sulphide, and air at a relatively high temperature (over 250 degrees Fahrenheit). Although aluminum pipe has not been successful in every case in such wells, it has given good results in many cases. This suggests that there migh be some applications of aluminum to air lift operation of oil wells, although this is by no means certain.

Aluminum Flow Tanks

The results of test installations of bolted aluminum tanks for handling the flow of high sulphide wells indicate that the application of aluminum for this purpose will be quite successful.

The first thorough test of tanks of this construction was made upon the Gulf Production Co.'s State Lassiter Lease in Crane County, Texas.[1] This tank was set for test in a battery in which steel bottoms failed in from five to six months and steel side walls, below the b. s. level, failed in from 12 to 14 months. The bottom of the aluminum tank was punctured by corrosion after 18 months service. The corrosion of this bottom was accelerated by the presence of a large quantity of iron sulphide formed by corrosion of a steel gauging well, as mentioned by Mr. Bignell in his description of the condition of this tank. However, there will always be present in such flow tanks a considerable quantity of iron sulphide from the steel well tubing and the steel flow lines. Therefore, the bottom would be expected to corrode quite rapidly. As a matter of fact, the life of the bottom of this lease tank was greater than had been anticipated. Corrosion of bottoms of flow tanks is not particularly serious in any case, since there are available many satisfactory methods for its prevention. The most important result of the test of this lease tank lies in the fact that the side walls and deck showed no measurable penetration by corrosion after 18 months of service. The side walls, below the b.s. level, had been etched by the corrosive brine, but there was no actual penetration of the metal. A further test of aluminum lease tanks is at present being conducted at Borger by the United States Bureau of Mines under the joint auspices of the Gulf Production Co., the Aluminum Co. of America and the Parkersburg Rig and Reel Co. The results of this will be of great interest.

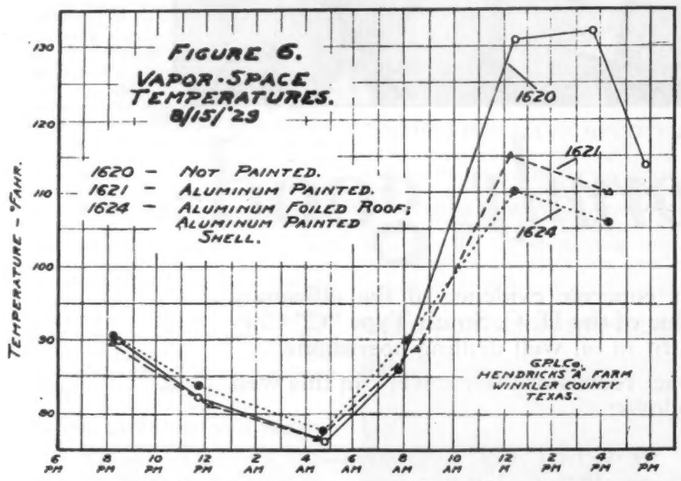
These aluminum tanks are constructed largely of an aluminum alloy containing approximately 1.25 per cent manganese. Duralumin (Alumin Co. of America's alloy 17S) is used for the bolts and for strong structural members. The cost is only about twice that of a steel tank of similar design. At this ratio of cost it seems fairly obvious that longer life of the aluminum tanks will justify the added investment under severe corrosive conditions. It is not certain that they will give equally good results in every case, but it seems certain that aluminum will find a wide application in the construction of such tanks.

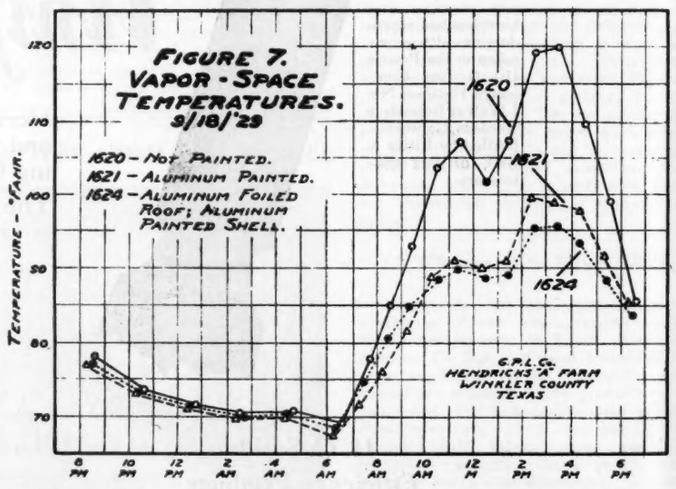
The success of aluminum in this case suggests a number of other possible applications. Thus it might be satisfactorily employed for the construction of gas separators which are exposed to very corrosive well fluids and gases. We have also experienced some difficulty from corrosion of electrical dehydrators, and it seems possible that aluminum might well be applied for this purpose. At the present state of our knowledge of the corrosion resistance of aluminum, it seems justifiable to consider aluminum as a possible material for use under any condition where resistance to well fluids, after they have left the well, is important. Any application of this nature should involve suitable precautions against dirt, iron sulphide, electrical contact with other metals, etc.

Natural Gasoline Plants

As stated above, aluminum is highly resistant to corrosion by sulphide bearing gases. This resistance has led to the successful application of aluminum in casinghead gasoline plants handling gases of

(Continued on Page 237)





*Before tenth annual meeting, American Petroleum Institute, Chicago, December, 1929.

[1]For construction of these tanks v. Chesley, The Oil and Gas Journal, May 17, 1929. For details of inspection after one year in service v. Bignell, The Oil and Gas Journal, July 4, 1929.

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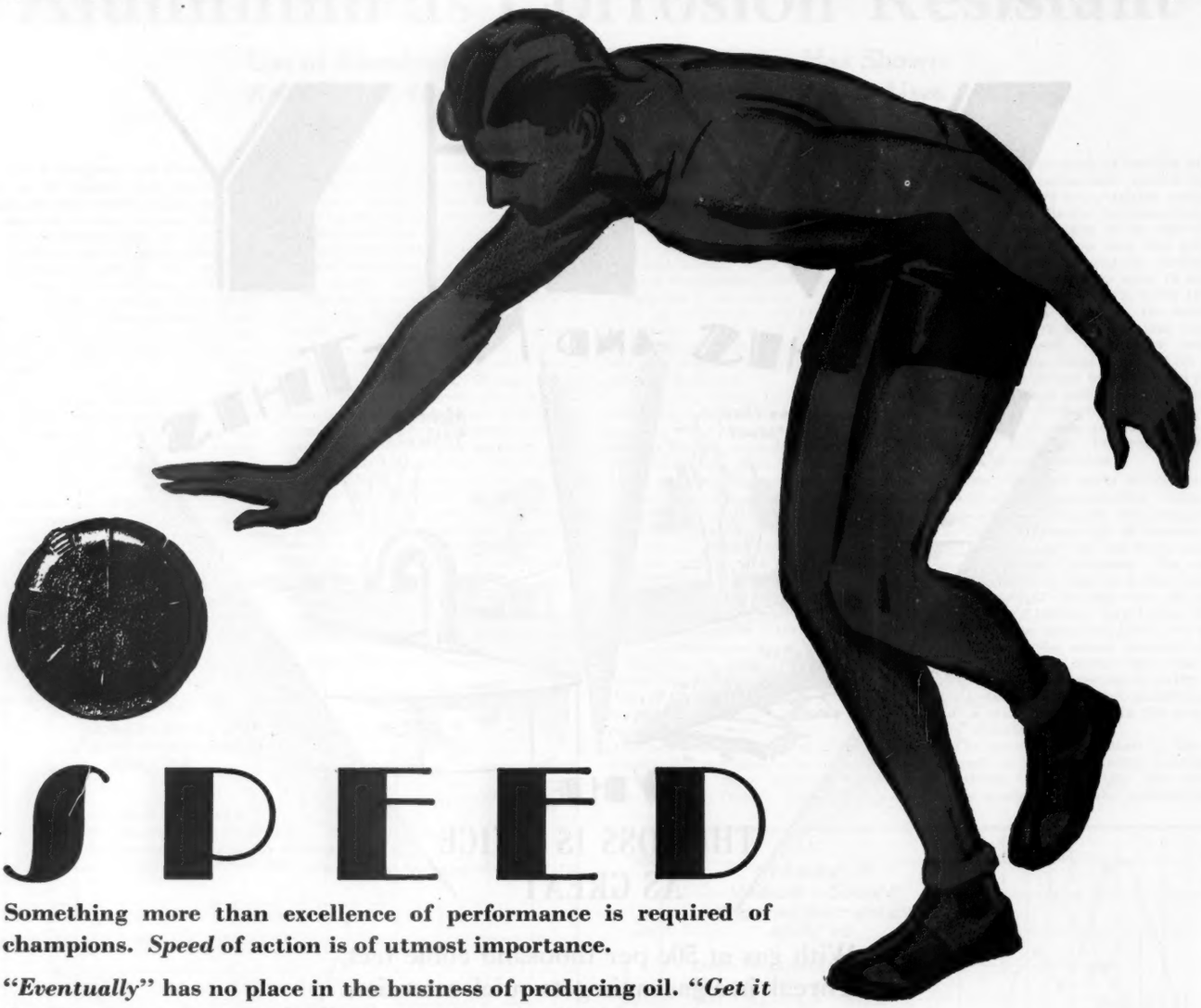

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Methods of Dewaxing Lubricating Oils

Processes Described and Results of Research Work Done Given and Explained. Many Mechanical Problems Encountered

By E. R. Lederer and R. Beattie
Texas Pacific Coal & Oil Co.*

The general procedure followed in the manufacture of Sharples bright stocks is as follows: The stock to be dewaxed is blended with naphtha in about a 30-70 mix in the order named. Characteristics of the naphtha vary according to the specific requirements of the stock being processed. Narrowness of distillation range seems to be the characteristic that affects economical operation the most. The endpoint should be below 400° F. to insure high gravity of the solution and the initial fairly high to avoid evaporation losses as much as possible.

The theory upon which this system of separation is based demands a differential in gravity between the precipitated wax and the solution from which the wax has been precipitated. The determination of this differential and the magnitude of it depends on the gravity of the naphtha used and the characteristics of the stock being dewaxed. Just as in cold settling, the greater the tendency of the wax to settle, the more wax removed under given conditions, in the Sharples Centrifuge, the greater the gravity differential the more separation occurs under given conditions.

After blending the solution is chilled comparatively slowly. From the blending temperature of from 100° F. to 110° F., down to 20 the hourly decrement varies from 3° to 5° F. from 20° F. down to the final temperature (from —20° F. to —50° F.) the chilling rate may be increased considerably. After reaching the final temperature the solution is fed continuously to the centrifuges.

Discharge of Wax

The essential feature of centrifugal separation of the wax from the lubricating oil is the continuous discharge of wax from the machines and for this purpose a special rotor has been constructed Hot water at a temperature of 140-145° F. is fed by jets into the head of the machine. The water being heavier than the wax or oil maintains itself as a flexible carrier in the form of a cylindrical layer on the pheriphery of the rotor of the machine. The stiff wax is deposited upon the surface of the water which conveys the wax from the machine, thus insuring a complete and continuous separation of the wax from the oil. Anything that will prevent or retard this continuous discharge of wax, such as insufficient water, clay or other foreign particles, will have a very marked effect on the resultant pour test of the wax free lubricating oil.

In order to produce subzero pour tests by centrifuging, conditions in the plant must be ideal. Extreme care must be taken in reducing to avoid cracking. Tar and asphaltic bodies must be removed in which are included the inhibitive or protective colloids which tend to keep the wax in solution.

Each centrifuge in the battery must be watched with extreme care, as the effect of one stream running high cold test makes a very marked effect in the aggregate. Special attention must be given the nature and quantity of the solvent used. If contact or percolation filtration is employed before dewaxing, the complete removal of "fines" is compulsory or the resulting deposit in the centrifuge bowls make low pour test impossible. It has been our experience after considerable work that the ultimate pour test obtainable by centrfuging a 90 viscosity at 210° stock is —10° F. This is accomplished by using a special naphtha as a solvent and chilling the solution to —50° F. This latter temperature is considered for the present by the authors as the lowest possible obtainable for economic operation.

A lower pour test, however, was obtained by altering the construction of the machine, so as to apply enough refrigeration, as near the bowl as possible, to offset the heating effect due to slippage and turbulence of solution in the bowl itself. Whether or not this problem can be worked out on a practical scale remains to be seen.

Weir Process

As it was the object of our research to determine the most economical way of producing subzero pour oils, we did not stop at the perception that the desired result could be obtained by centrifuging alone. The next step was to investigate the Weir process, which lately has undergone considerable testing by many companies. The principle employed in wax separation in the Weir process is very simple in the words of Janus W. Weir:

"There is nothing mysterious about the process which consists of changing the filter cake from an impervious mass to a porous substance in the filter process by the use of a filter aid wherein a finely divided solid porous substance, such as diatomaceous earth, is mixed with a wax containing solution and extracted with the wax adhering thereto in the filter press. This simple statement should make it obvious that a differential in gravity in the process is immaterial and that it is practical also for extracting wax of any nature from any stock."

The nature of this process makes it particularly adaptable to the stocks manufactured by the authors. Considerable research and development has been carried on in the laboratory and some very good results were obtained. Before any semblance of commercially economic results were obtained, however, several mechanical problems had to be ironed out.

To begin with, we were aware that to produce the subzero pour tests we wanted, it would be necessary to chill the solution to at least —40° F. A 3-ton Baker Ice machine was used to supply refrigeration. In order to maintain capacity at these low temperatures (ammonia liquor —50° F.) it was found necessary to install a small air compressor which was converted to act as an ammonia gas booster.

The chilling tank itself consisted of the tank proper, a one-fourth inch plate with a dished bottom and no top. Insulation was attained by making a sheet metal jacket one foot in diameter larger than the tank, affording a 6-inch annular space which was filled with ground cork. Suitable drains and outlets were provided by welding nipples in the bottom and sides.

Provision for mixing the cell was made by installing a jet mixing box and hopper. Dry Filter-cel was emptied into the hopper and the jet action supplied by a small pump mixed the solution and cell, sending it back to the tank. A stirring device was installed in the tank to keep the cell in suspension. The pump used was of the typical rotary type, gear driven by a small motor.

Type of Press

Considerable thought was given the type of press to be used. After much consideration, one was selected which embodied all of the most desirable operating features. For example, in operation the opening of the press was not necessary for the dumping of the cake, this being accomplished by a continuous closed discharge arrangement. Again, by the construction of the press, it was assured that an even cake would be built upon the leaves. A particularly desirable feature was the ease with which the whole system could be made vapor tight, thus reducing solvent loss by evaporation. Steaming of the cake for the removal of solvent is possible and consequently will reduce the solvent loss in the cake.

In the laboratory stage of this work, very encouraging results were obtained, pour points being secured from —18° F. to —28° F. on stocks ranging from 120 viscosity at 210 to 200 viscosity at 100° F. Such work was accomplished by using gallon samples and vacuum filtering through a wax leaf with a small laboratory vacuum pump. When large scale experimental work was started, weaknesses in the system showed up at once. In spite of ample insulation the solution warmed up 20° F. between the tank and the filter press. The filter-cel settled out in the lines and pumps and refused to move. Moisture from the atmosphere settled in the solution, froze in combination with the cell and very effectively plugged the lines. The agitator was running too fast, throwing the cell to the outside of the chilling tank, giving a small amount of cell at the start of the run and a large excess at the last of the run.

The first corrective step taken was to install the press in a specially constructed cold room 6 feet by 6 feet by 8 inches and refrigerated by another 3-ton Baker unit. With this arrangement, the press and cold room could be chilled down to —30° F. before the run was started. At the conclusion of the first run with this new installation an initial temperature of —25° F. was noted. Investigation proved that in circulating the solution through the press the heat equivalent of the work done on the solution by the pump was the cause of most of the temperature rise. Inspection of the connecting lines between the tank, pump and press disclosed many fittings which would produce additional turbulence tending to put the wax back into solution.

In addition to these difficulties, the cell by nature is extremely abrasive. It was found by trial that the pump, although a slow speed rotary type, wore out very quickly in pumping service. Another gear type pump was installed with not much better success, the amount of abrasion being almost prohibitive from an economic standpoint.

Another series of changes took place. The agitator in the tank was redesigned to give a minimum turbulence to keep the cell in suspension and reduce the centrifugal effect. The location of the press was altered so as to bring the press inlet connection not more than three feet from the tank outlet. In place of pumping the filter cel bearing solution, a top was installed on the chilling tank and natural gas used to blow the solution to the press. The method of mixing the cell was changed so that no heating due to jet action was experienced.

At the conclusion of these and other minor changes in the whole installation several successful runs were made. Noted below is a typical report on one of these runs.

Low Temperature Dewaxing

It had become evident in the previous runs with the special filter press that the cold oil was warmed up too much before it could reach the press on account of the long line connecting the press with the chilling tank. In order to get around this trouble, a small four-leaf filter was installed directly underneath the chilling tank. The filter drum has a jacket for cooling from the outside with ammonia. The leaves can be cleaned by unbolting the front plate of the drum.

One hundred sixty gallons of wax free oil from the Sharples plant were chilled to —42° F. Two runs were made: Number 36 with one-half pound of Hy-flo Super-Cel per gallon of stock and No. 36 with one pound.

The addition of one pound of filter aid per gallon of stock to a 25/75 solution of oil in naphtha as the one used in the present runs raised the temperature from —42° F. to about —36° F. The temperature of the oil in the chilling drum was —42° F. at the start. During run Number 35 the temperature in the chilling drum was —39° F. one-half pound of Hy-flo Super-Cel having been used; and during Run Number 36 the tank was at —36° F.

TABLE 1

Test on wax free oil: Pourpoint +20° F.		
Run No.—	No. 35	No. 36
Temperature of solution in drum	—39° F.	—36° F.
Amount of Hy-flo Super-Cel	½ lb.	1 lb./gal./stock
Filter rate	15	17.5 gal./sq.ft./hr.
Cake thickness	½ inch	1 inch

Samples of run No. 35:				
Sample No.—	1	2	3	4
Outlet Temp.	—25	—35	—25	—28
Filter pressure	10	18	32	41
Pour point	—10	—10	—12	—12
Gravity	24.6	24.6	24.8	24.2
Flash	435	436	440	445
Fire	495	505	495	510
Vis./210° F.	82	80	81	87

Samples on run No. 36:				
Sample No.—	1	2	3	4
Outlet Temp.	—24	—24	—24	—24
Filter pressure	12	21	40	49
Pour point	—6	—6	—4	—6
Gravity	24.5	24.5	24.2	24.8
Flash	440	440	435	435
Fire	505	505	500	500
Vis./210° F.	84	84	84	83

Discussion

In our estimation, considering the short connection between chilling drum and filter, and in spite of the high outlet temperatures, the temperature in the press was not more than 2° to 4° F. higher than the temperature in the chilling drum. Based on this assumption, we arrive at filtering temperatures of about —36° F. and —33° F. for runs No. 35 and No. 36 respectively. The average pourpoints are —10 for No. 35 and —6

(Continued on Page 172)

BIG TEMPERATURE CHANGES

The phenomenal growth of aviation, making it possible for a plane to leave a temperate zone and the same day land in a frigid zone, together with the constantly increasing use of automobiles in winter, has led to improved dewaxing methods. The usual practice in the manufacture of paraffin base motor oils had been to blend a cold settled bright stock with a pour from 40° to 60° F. with a neutral produced from a wax distillate partially dewaxed by pressing. The pourpoint of the neutral ranged from 20° F. for a single pressed to as low as 0° F. for a double pressed product. The resultant pourpoint of the blend usually ran from 20° to 50° F. The newer methods give bright stocks with pours between +20° and —10° F. with therefore correspondingly lower pours on the blend.

*Delivered at tenth annual convention, American Petroleum Institute, Chicago.

Stabilizing Knock Rating, Gum, Color

New Chemical Inhibitors and Stabilizers Have Been Found. Processes for Restoration of Depreciated Gasoline

By Gustav Egloff, W. F. Faragher and J. C. Morrell
Universal Oil Products Co.*

One of the urgent problems of the refining industry is the stabilization of gasoline with respect to knock rating, formation of gum, and color. The development of color and the formation of gum in stored gasoline have been known for some time. The problem of the depreciation of the knock rating of some cracked gasolines has arisen recently. Gases are known in which gasolines have dropped from a benzol equivalency of 40 per cent to minus 13 per cent after a month of commercial storage. Highly cracked gasolines depreciate particularly rapidly in regard to the knock rating, gum, and color. Such gasolines have been found to deteriorate markedly in a few days.

The extent to which stored gasoline depreciates depends upon many factors, among which are oxidation by air, light, and heat. Cracked gasolines are inherently more susceptible to depreciation than the straightrun products, owing to the difference in the amount and kind of unsaturated hydrocarbons present. However, changes in color, amount of gum, and knock rating of most properly refined cracked gasolines are so small as to cause no material difficulty. Although the field has not been investigated thoroughly, the character of the charging stock and the conditions under which it is cracked are probably the factors that determine the stability of the refined gasoline.

The formation of undesirable gums or resins is not limited to the petroleum industry. Industries dealing with turpentine, aldehydes, alcohols made from cracked gases, vegetable oils, and rubber are also confronted with the formation of gummy or resinous substances in their products. Oxidation by air seems to be involved in all these changes.

This paper presents the results of a study of the changes of knock rating, content of gum, and color which cracked gasoline undergoes and of methods of stabilization.

Chemical inhibitors have been found which substantially prevent the lowering of knock rating, stabilize color, and check gum formation during storage. Processes have been devised also for restoring the knock rating of deteriorated gasoline to its original benzol value.

Changes in Knock Rating

A number of cracked gasolines which had been in storage for periods varying from six months to nearly two years were retested for knock rating. Several samples showed no change but others had dropped by as much as 65 per cent of the original benzol equivalent.

Table 1 shows the change in knock rating of a number of these cracked gasolines.

Chemical Inhibitors to Stabilize

When some gasolines are stored for relatively long periods of time, oxidation products are formed, some of which are gum or gum-forming substances. The oxidized products consist in part of peroxides, acids, aldehydes, and ketones. Coincident with their formation there is a drop in knock rating of some cracked gasoline during storage. Aniline, hydroquinone, naphthalene and anthracene have been found in this investigation to inhibit the changes that decrease the knock rating during storage. The same substances are also effective in preventing a reduction in knock rating when the gasolines containing them are subjected to the accelerated oxidation test for gums proposed by Voorhees and Eisinger[1], namely heating the gasoline to a temperature of 212° F. in an atmosphere of oxygen for a period of five hours.

In a set of experiments using a Pennsylvania cracked gasoline, the accelerated oxidation test lowered the benzol equivalent from 40 to 29 per cent. The addition of 0.1 per cent by weight of aniline or hydroquinone to the crack gasoline preserved the knock rating when the gasoline was subjected to the same accelerated oxidation test conditions. Naphthalene and anthracene also acted as inhibitors but to a lesser degree than aniline and hydroquinone.

In another set of experiments using a Mid-Continent cracked gasoline, aniline gave poor stability while the other inhibitors mentioned gave good results.

The following data show the detailed experimental results.

TABLE 1—KNOCK RATING OF CRACKED GASOLINES BEFORE AND AFTER STORAGE

Months in storage	Metal container (tinned iron) condition after storage	Cracked gasoline source	Cracked gasoline A.P.I. Gr.°	Cracked gasoline I.B.P. °F.	Cracked gasoline E.P. °F.	Benzol equivalent Delco motor test Before storage	Benzol equivalent Delco motor test After storage
6	Clean	Smackover	58.4	100	419	45	46
11	Red gum deposit	South Field, Ark.	62.3	110	367	35	15
11	Slight deposit	South Field, Ark.	60.3	103	388	32	30
12	Clean	Mid-Continent	59.8	113	389	37	38
12	Clean	Mid-Continent	59.6	110	391	37	34
12	Clean	Mid-Continent	60.1	103	391	35	20
12	Clean	Mid-Continent	59.2	106	402	37	12
23	Clean	Mid-Continent	63.9	112	377	40	31
23	Clean	Mid-Continent	58.4	104	422	42	32
23	Clean	Mid-Continent	61.0	106	400	45	36

CHEMICAL INHIBITORS AND KNOCK RATING PENNSYLVANIA CRACKED GASOLINE

	Original Gasoline	After oxidation	Aniline	Hydroquinone	Urea	Phenol	Naphthalene	Anthracene
I. B. P. °F.	94	114	112	105	130	114	108	122
E. P. °F.	427	434	429	430	431	432	434	445
Color Saybolt	24	—16	—16	Yellow	—5	Yellow	0	—2
Mgs Gum Copper dish	19	220	55	16	56	139	241	75
Mgs Gum Glass dish	3	55	5	6	14	36	36	20
Hydrocarbons[2]								
Per cent—								
Unsaturates	24.0	23.0	....	....	....	....	....	....
Aromatics	22.9	22.5	....	....	....	....	....	....
Naphthenes	9.3	10.1	....	....	....	....	....	....
Paraffins	43.8	44.4	....	....	....	....	....	....
Delco Motor Test								
Benzol Equivalent Per Cent	40	29	39	40	34	31	35	34
Mid-Continent Cracked Gasoline								
I. B. P. °F.	103	114	106	110	108	107	108	118
E. P. °F.	320	335	319	313	301	302	313	312
Color Saybolt	30	7	—16	13	26	16	28	28
Mgs Gum Copper dish	68	475	389	26	198	131	126	73
Mgs Gum Glass dish	1	136	29	3	13	16	5	3
Hydrocarbons								
Per cent—								
Unsaturates	36.2	41.1	....	....	....	....	....	....
Aromatics	12.0	7.8	....	....	....	....	....	....
Naphthenes	11.9	11.7	....	....	....	....	....	....
Paraffins	39.9	39.4	....	....	....	....	....	....
Delco Motor Test								
Benzol Equivalent Per Cent	56	37	34	52	40	47	47	47

[2]Egloff and Morrell, J. Ind. Eng. Chem., 18, 354 (1926). This method was used throughout.

The following data cover a Mid-Continent cracked gasoline of 410° F. endpoint which was stabilized by chemical inhibitors, as far as its knock rating was concerned.

	Color before oxidation	Color after oxidation	Gums mg. per 100 cc. Copper dish	Benzol equivalent per cent (Delco Motor Test)
Gasoline Alone—				
Before oxidation	20		25	32
After oxidation		Yellow	331	15
With Inhibitors (0.1 per cent by wt. of gasoline)				
Aniline	Yellow	Yellow	9	36
Dimethylaniline	16	Yellow	22	30
Diethylamine	16	Yellow	337	30
Hydroquinone	20	Yellow	11	31
Anthracene	18	Yellow	60	30

Aniline is a stabilizer and also has antiknock properties of its own when added to gasoline. The increase of 4 per cent of benzol is the calculated amount for the quantity of aniline added.

Oxidation Test

A California cracked gasoline showed marked stability in regard to knock rating when subjected to the accelerated oxidation test. This would indicate that the oxidation products in this gasoline did not affect its knock rating. Although the gum was increased by oxidation, the benzol equivalent was decreased only from 55 to 51 per cent, and a Pennsylvania cracked gasoline subjected to the same conditions of oxidation depreciated in benzol value from 40 per cent to 29 per cent, while a Mid-Continent motor fuel dropped from 56 per cent to 37 per cent. This difference may be due to the nitrogen compounds present in the California cracked gasoline which act as antioxidants or inhibitors.

Table 5 summarizes the changes in knock rating of four cracked gasolines subjected to the accelerated oxidation test.

Gum and Knock Rating

From a study of the data there appears to be a relationship between the depreciation in knock rating and the increase in gum formation. Generally speaking, those materials which inhibit gum formation also check depreciation in knock rating, although there are some exceptions to this generalization, e.g., diethylamine will inhibit the depreciation of knock rating under the test conditions but does not prevent increase in gum. On the contrary it appears to promote gum formation. Other substances which act as inhibitors in preventing knock depreciation fail to prevent increase in gum.

The formation of easily oxidizable gum-forming materials is accompanied in some cases by a depreciation in knock rating. It cannot be generalized, however, that the two phenomena are directly related because the addition of inhibitors may prevent decrease in knock rating without preventing gum formation.

Gum in Cracked Gasoline

The formation of gums in highly cracked gasolines was noted by Hall[3] in 1915. He recognized that it was an air oxidation process and unless the gasoline was properly refined would "clog and stick up the valves of any engine in which it may be used." With some cracked gasolines gum formation is still a problem from a theoretical and a practical viewpoint.

Moureu and Dufraisse[4] have made an extensive study of the effect of antioxidants in preventing the oxidation of sensitive materials such as furfural, acrolein, styrol, linseed oil, which ordinarily under oxidizing conditions would develop color or form gum-like substances. These authors have found that a mere trace of pyrogallol will prevent the oxidation of acrylic aldehyde, for example, even in an atmosphere of oxygen.

The National Benzol Association of England[5] has reported upon the gum or resin formation in benzol motor fuels. They have found that tricresol acts as an inhibitor of the formation of gum. Some experiments indicate that a chemical inhibitor in a benzol motor fuel may act as an accelerator in some containers. Gum formation is also dependent upon the percentage of inhibitor added; a small quantity may act as an inhibitor of gum and a larger quantity as an accelerator.

Influence of Water

Water has some influence on gum formation, but quantitative data are lacking.[6] Water may act either as a gum inhibitor or accelerator. Hence, it is extremely important that in all studies of gum formation in motor fuels the quantity of inhibitor, presence of water, type of container, oxidizing agent, temperature or light effects should be reported.

When cracked gasolines are subjected to oxidation by air or oxygen, the formation of gum increases. Of the gasolines used in these tests those from California and Pennsylvania were found to be more resistant to gum formation than the gasolines from the Mid-Continent. The data are shown in Table 6.

Tests of Inhibitors

A series of chemicals were tested as inhibitors of gum formation during exposure to sunlight in the presence of

(Continued on Page 257)

*Before Group Meeting on Refinery Technology, American Petroleum Institute, Chicago, Dec. 5, 1929.

[1]A.P.I. Refinery Technology, Section II, 169, (1928).

[3]J. Inst. Petr. Tech., page 147, 1915.

[4]Moureu and Dufraisse, Chem. Rev. 3 July (1926.)

[5]Nat'l Benzol Assoc. of England, Report of Research Com., page 61 (1929).

[6]Nat'l Benzol Assoc. of England Report of Research Com., p. 67 (1929).

TABLE 4
ACCELERATED OXIDATION TREATMENT OF CALIFOENIA CRACKED GASOLINE

	Original Gasoline	After Oxidation
I.B.P.—Endpoint °F.	92°—428°	125°—435°
Color, Saybolt	30	Yellow
Mgs. gum (copper dish)	11	77
Mgs. gum (glass dish)	Trace	32
Hydrocarbons, in Per Cent		
Unsaturates	19.4	23.4
Aromatics	25.2	24.1
Naphthenes	13.4	12.4
Paraffins	42.0	40.1
Delco Motor Test		
Benzol Equivalent, Per Cent	55	51

TABLE 5

Gasoline	End-point I.B.P.	End-point E.P.	Benzol Equivalent, Per Cent Delco Motor Test Original Gasoline	Benzol Equivalent, Per Cent Delco Motor Test Gasoline after Oxidation
California	92	428	55	51
Pennsylvania	94	427	40	29
Mid-Continent	103	320	56	37
Mid-Continent	107	411	36	21

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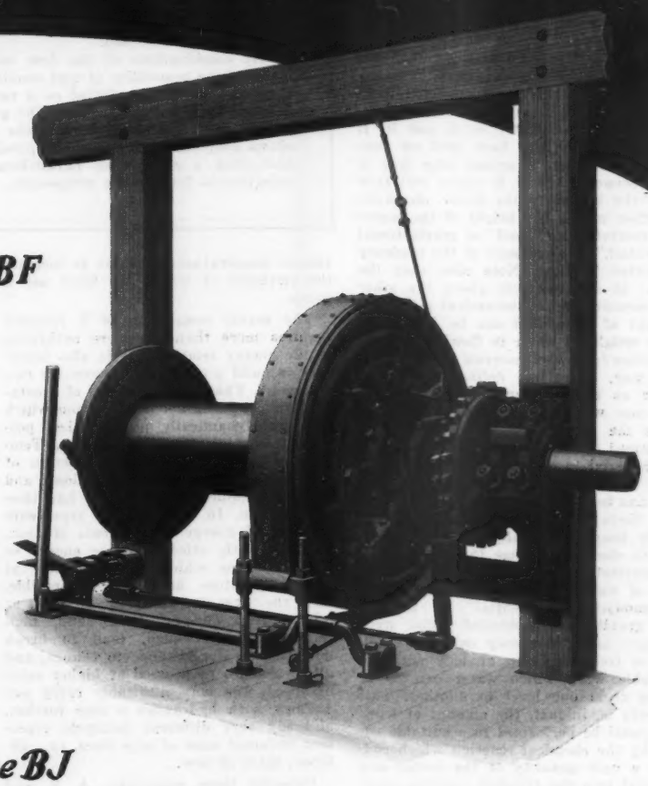

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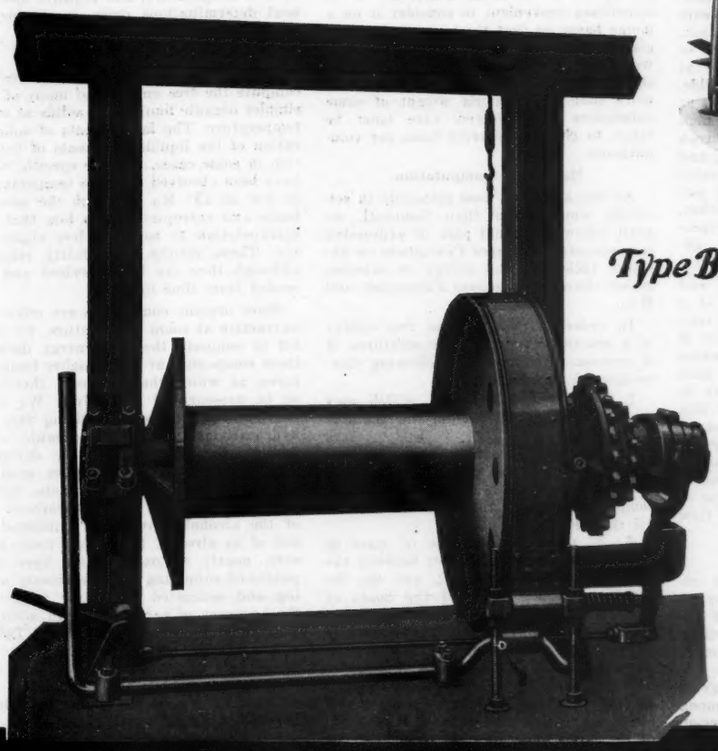

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Applications of Thermodynamics

Possibilities and Limitations of Methods in Predicting Chemical Reactions of Petroleum Products

By A. W. Francis and R. V. Kleinschmidt
Arthur D. Little, Inc., Cambridge, Mass.*

ABSTRACT

The possibilities and limitations of thermodynamic methods in predicting reactions of organic compounds are discussed. Equations have been derived for the free energies of formation as simple functions of temperature for numerous hydrocarbons, alcohols, and related organic compounds which might be derived from petroleum. In doing this use has been made of the third law of thermodynamics, and of scattered data on chemical equilibria, vapor pressure, specific heats, and heats of fusion, vaporization, and reaction. In some cases missing and conflicting data were supplied by estimates, and the gaps thus revealed suggest opportunities for research of fundamental and technical importance. As such data are supplied, the calculations can be revised.

By combinations of the free energy equations predictions have been made of the possibility of and conditions for proposed reactions. The equations also have been plotted on a rational basis which permits similar predictions by simple inspection. The graph also illustrates a method used in certain cases for circumventing the above simple deductions. Another plot shows graphically the synthetic possibilities of water gas. The lines of this plot show a remarkable parallelism which may simplify thermodynamic calculations for organic compounds.

One of the major problems of theoretical chemistry is to predict what useful chemical products can be made from given raw materials, such as petroleum, water gas, coke, etc. In the present paper we present criteria by which the probable course of certain reactions can be predicted. The scientific basis and mathematical deduction of the methods used have been clearly laid down by Gibbs and others. Since the rigorous derivation is tedious and not too easily followed, we shall endeavor to point out the significance of the values given below by means of a simple analogy.

If it is desired to predict whether water will flow from one reservoir A to another B when they are connected by a suitable pipe, it is only necessary to measure the level of water in A and in B from some arbitrary base, and we then know that when a proper pipe line is built between A and B water will flow from the higher to the lower reservoir. In other words, the height of the water in a reservoir, its "head" or gravitational "potential," is a measure of the tendency of water to flow. Note also that the height of one reservoir above the other is a measure of the theoretical maximum amount of work that can be done by a given weight of water in flowing through a turbine from one reservoir to the other. We may, therefore, define "potential" either as the tendency of material (in this case water) to change its position, or as the available work that could be performed by allowing a unit quantity of the material to change its position.

Thermodynamic Potential

It has been shown by Gibbs and others that there is a property of substances which bears practically the same relation to chemical change that the "head" or gravitational potential bears to the flow of water. Gibbs calls this property "thermodynamic potential" by analogy with gravitational potential. Other writers have more commonly called it available or free energy by analogy with the available work which water can do in falling from one level to another. This property is, in fact, the amount of work that could be performed in a suitable engine by the chemical reaction which converts a unit quantity of the initial raw material into the finished reaction products. Unfortunately, there are a number of ways of expressing this essential property, all simply related, but each possessing advantages for certain types of problems. This has led to serious confusion, especially since many writers seem especially intrigued by the term "free energy," and have applied it to various concepts.

For various reasons we have chosen to use Gibbs' "thermodynamic potential," better known to chemists as Lewis' "free energy," and which we shall refer to by that name. Like entropy, free energy is expressed in rigorous mathematical form by an equation:

$$dF = dH - TdS - SdT$$

where F is free energy, T is absolute temperature, S is entropy, and H is total heat.

Free Energy

The free energy per unit weight is, for chemical substances and changes, the analogy of elevation in hydraulic work. If we wish to bring about changes in a substance which increase its free energy, we must actually do work on it either mechanically by compression, or electrically by electrolysis or ionization, or, finally, thermally by operating at properly chosen temperatures; just as to increase the elevation of water, we must use a pump.

The actual completion of a reaction requires more than the mere satisfying of the energy relations. It is also necessary to build a pipe line between the two reservoirs. This is the function of a catalyst, viz., to bring about a reaction which is thermodynamically possible, i.e., possible from the energy standpoint. Temperature often performs the function of a catalyst in accelerating reactions, and is easily applied. Temperature has thus a dual role. In so far as it represents addition of energy in the form of heat, it can directly affect the free energy so that reactions which are impossible at one temperature may become possible, from the "free energy" point of view, at others. And on the other hand, high temperatures, as such, tend to break down chemical resistance to change, and allow changes to proceed at higher rates of speed. We may profitably carry our analogy with hydraulics a step further, and say that different catalysts represent different sizes of pipe lines, i.e., different rates of flow.

Consider three reservoirs: A, B, and C. A is at the highest level, B is at a somewhat lower level, and C is at a very much lower level than B. If A and B are connected by a very large water main, while A and C are connected only by a 1-inch pipe, most of the water in A will flow into B and very little into C, even though the tendency to flow to C is very much the greater. However, if A and B are on the same level, or if B is higher than A, it would obviously be impossible to find any simple pipe of any size that would cause water to flow of itself from A to B.

Limitations of Theory

This analogy indicates at once the importance and the limitations of thermodynamic theory and the relation of catalysts to chemical reactions. Reactions can proceed only from states of higher to states of lower free energy, just as water flows only downhill unless energy is imparted to it, as by a pump. Among several possible products of a reaction it is, therefore, possible to influence the relative proportions of the final products by a suitable choice of catalysts. The free energy relations give no information whatever as to which of the possible products will necessarily be obtained, although reactions involving large drops in free energy are usually more likely to occur than those involving small drops, just as water is usually found in the bottoms of valleys instead of high up on the mountains.

Free energy is primarily a function of pressure, temperature, and chemical composition. Under some conditions, it is also necessary to know the physical state—whether gaseous, liquid or solid—and the crystalline form.

Although free energy per unit weight is an intensive function like head of water, the free energy of a reaction is an extensive function, being proportional to the amount of substance involved. In applying it to chemical reactions, it is sometimes convenient to consider it on a molar basis, so that the numerical values given refer to calories per gram formula weight, unless otherwise stated. In considering several complex reactions where more than one formula weight of some substances are involved, care must be taken to choose a correct basis for comparisons.

Manner of Computation

As free energy is used primarily in scientific work rather than technical, we shall follow the usual plan of expressing temperature in degrees Centigrade or absolute (Klevin), and energy in calories, rather than using degrees Fahrenheit and B.t.u.

In order to compute the free energy of a reaction at various temperatures, it is necessary to know the following thermodynamic properties:

1. The heat of reaction, which may be obtained indirectly from the heats of combustion, etc.
2. The change in free energy at some one temperature and pressure.
3. The specific heats as functions of temperature of all the reactants and of all the products.
4. If there is a change of state of any reactant or any product between the conditions mentioned in 2, and the desired conditions, then all the heats of fusion, vaporization, or transition involved are required; and it aids greatly in checking calculations if vapor pressures of liquid and solids are known.
5. If high pressures are involved in an observed equilibrium or in the desired conditions, the equations of state of the gases must be used to correct the pressures.

The largest error is due usually to inaccuracies in heats of combustion. That of ethylene, for example, has been given by various good authorities from 332,000 to 345,800 calories. This makes a variation of from 7,000 to 21,000 in heat of formation, which is the function employed in free energy calculations. An experimental revision of some of the heat of combustion data would increase greatly the accuracy of free energies.

Two Methods Available

Two methods are available for estimating some one free energy value with which to start. (The electrical method is not available for nonelectrolytes such as we shall consider.) One is based upon observed equilibria of the reactants and products with each other, with their elements, or with other compounds whose free energies are known. Free energy of reaction ΔF is related to the equilibrium constant by the equation:

$$\Delta F = -RT \ln K$$

where R is the gas constant 1.9885 calories, T is the absolute temperature, and lnK is the natural logarithm of the equilibrium constant, pressures being expressed in atmospheres. Relatively few organic compounds may be subjected to such equilibrium conditions. The other method is based upon the third law of thermodynamics, and assumes that the free energy of reaction at absolute zero is equal to the heat of reaction at the same temperature. On this assumption we can compute the free energy of a reaction at constant temperature by the equation:

$$\Delta F = \Delta H - T\Delta S$$

where ΔH is the heat of reaction and ΔS is the change in entropy. The entropy in this case is measured above the absolute zero of temperature, and requires specific heat determinations down to the neighborhood of absolute zero.

Computing Free Energy

Recently this method has been used to compute the free energies of many of the simpler organic liquids and solids at room temperature. The latent heats of solidification of the liquids, the heats of transition in some cases, and the specific heats have been observed down to temperatures as low as 15° K., at which the specific heats and entropies are so low that the extrapolation to zero involves slight error. These results seem fairly reliable, although they are being revised and extended from time to time.

Since organic compounds are relatively unreactive at room temperature, we were led to compute the free energy data of these compounds at much higher temperatures, at which they do react thermally or in presence of a catalyst. We were particularly interested in doing this for hydrocarbons and other organic compounds derivable or possibly derivable from petroleum. This includes most of the simpler organic compounds. Calculations for many of the hydrocarbons and of the alcohols have been published by one of us already. Since that time, however, nearly a dozen papers have been published supplying data previously missing and estimated by us, or improving the accuracy of earlier data. In addition, Volume 5 of International Critical Tables, which contains thermal data, has appeared. Its critical analysis of some conflicting data has made our choice less arbitrary and given us greater confidence in the results. Accordingly, all the calculations of free energies have been repeated, and are summarized in this paper. We were gratified to find that in no case was it necessary to change previous conclusions substantially. Some additional calculations and conclusions are presented. Even yet, many gaps in the data must be supplied by estimates, more or less reliable. These gaps suggest op-

(Continued on Page 262)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 5, 1929.

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Cause of Corrosion in Cracking Plants

Experiments Conducted to Determine Main Cause and as Far as Possible Mechanism of Corrosion in Such Plants

By E. Retailliau and F. R. Lang
Shell Petroleum Corp., Wood River, Ill.*

The question of the fundamental cause of corrosion in the cracking plants using a sulphur-containing charging stock has been often discussed. It was usually accepted that this corrosion was due to sulphur compounds, especially to hydrogen sulphide; however, hydrochloric acid has been also suggested as a possible cause of this corrosion, this acid being produced by hydrolysis of dissociable chlorides, viz., magnesium chloride.

It has not been our intention to determine quantitatively the actual corrosion due to the various corrosive compounds present in the charging stock of the cracking unit or formed during the cracking operation. The following study was undertaken with the purpose of determining the main cause and, as far as possible, the mechanism of the corrosion in cracking plants.

Besides the laboratory experiments conducted on pure chemicals of the various groups as detailed later, data were obtained during plant operation from a Dubbs cracking process unit in order to check the laboratory results. Therefore, in the first part of the study, the laboratory experiments are reported in detail, while in the second part data pertaining to plant corrosion are given.

No data are given as to the corrosion due to the hydrogen sulphide when moistened because such corrosion is well known. It will be mentioned, however, that the corrosion in this manner takes place for only a short time during the steaming period when the plant is being shut down.

Laboratory Experiments

The chemicals studied include hydrogen sulphide, hydrogen chloride, sulphur dioxide, sulphur, naphthenic acids, organic sulphur compounds such as disulphides, and inorganic chlorides such as sodium and magnesium chlorides, the latter in its various forms.

The chemicals used were as pure as were available on the market. We prepared some others, and all of them were carefully dried before being allowed to react on the iron and steel of the test.

To test their action, we used strips of wrought iron 2½ inches by five-eighths inch by one-eighth inch and of steel 2½ inches by five-eighths inch by one-thirty-second inch. In most cases, we used two strips of each sort, one polished while the other was used as purchased. The polished one was to emphasize the action of the chemicals, as their action might otherwise not have been noticeable because of their small quantity and the relatively short time of the experiment.

A knowledge of the individual action of the chemicals and their presence or absence in the charging stock of the cracking plants will aid us to reach a conclusion as to the real cause of corrosion of cracking plant equipment.

For convenience we divided our experiments into three series.

A. First Series: Experiments Using Hydrogen Sulphide, Hydrogen Chloride and Sulphur Dioxide.

Apparatus—The apparatus consisted of a combustion tube of silica, heated by means of an electric combustion furnace, equipped with a rheostat allowing an accurate regulation of the temperature. The ends of the tube were closed with rubber stoppers with two holes giving way on one end to the tube bringing the reacting gas and to the pyrometer well, and on the other end to the control thermometer and to a two way stopcock connected with a manometer and with an air aspirator, so as to keep atmospheric pressure inside the silica tube. Inside the silica tube, iron and steel strips were placed in a horizontal position.

When the gas to be tested was dry, the gas was allowed to pass through in the cold until all the air was removed, this being made easier by slightly reducing the pressure on the other end of the combustion tube. When the atmosphere in contact with the strips in the silica tube consisted only of gas to be tested, the heat was turned on and the temperature brought slowly to about 900° F., the current of gas being stopped when this temperature was reached. The stopcocks were then closed on both ends and the gas left to react on the strips. From time to time by turning the stopcock on the manometer, we could control the pressure inside the combustion tube and, accordingly, introduce some more gas or release the excess of pressure, so as to keep always an excess of gas in contact with the strips.

On the releasing line connected with the air aspirator, a washing bottle filled with a suitable reagent to absorb the outgoing gas was placed.

In all cases the experiment was run for 24 hours; and after the experiment was completed, the reaction tube was cooled to room temperature before being opened, so as to prevent any possible action of the air. As soon as the tube was opened, the strips were cleaned as well as possible, using a wood spatula to remove the harder scale, and the cleaning was completed by rubbing with a clean cloth and petroleum naphtha free from sulphur. The strips were then dried for two hours in the oven at 110° C. and weighed. The resulting loss of weight has been taken as a matter of comparison for the corrosive reaction of the chemicals tested. The scale was recovered also and examined.

Comments on the Experiments

1. Action of Hydrogen Sulphide—The temperature of 864° F. was reached 1½ hours after the heat had been turned on, and then the gas was left in contact with the strips. After 15 minutes, it was necessary to release the pressure inside the tube. After two hours, on the other hand, there was a noticeable drop in pressure in the tube, probably due to diffusion of the gases through the glass and stoppers, and more hydrogen sulphide was introduced. After standing in contact overnight, there was almost no hydrogen sulphide left in the tube as tested by interposing a washing bottle containing a silver nitrate solution on the suction line; but, when replacing this washing bottle by one containing pure water, a fine colloidal suspension was observed. The same fact was observed again a few hours later when ending the experiment. This is extremely interesting, because this suspension, upon examination, was identified to be free sulphur, evidencing the dissociation of hydrogen sulphide at the temperature of the experiment and confirmed by the yellow deposit seen on the cold parts of the tube.

The free sulphur was identified by shaking the water suspension, part with carbon disulphide and part with benzol, and evaporating the solutions on a water bath, running at the same time a blank test with the pure carbon disulphide used. The evaporation to dryness left a deposit of crystals of rhombic sulphur, easily recognized from their aspect and by burning with the characteristic odor of sulphur dioxide and its blue flame. The amount of free sulphur thus liberated was quite large, and led us to believe that the action of hydrogen sulphide on iron might result from dissociation into hydrogen and sulphur, especially if we remember the ease with which free sulphur and iron react together, as will be demonstrated later. We believe that the mechanism of the reaction might be:

$$H_2S \leftrightarrows H_2 + S$$
$$Fe + S \leftrightarrows FeS$$

and possibly:

$$FeS + H_2 \leftrightarrows Fe + H_2S$$

Of course, there make also be a direct attack of the iron by H_2S.

These reactions may explain in this

(Continued on Page 157)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 4, 1929.

Tests in Bright Stock Manufacture

Determining Effect of Free Acid in Treated Stock With Respect to Decolorizing and Neutralizing Value of Clay

By R. D. Evans
Independent Oil & Gas Co., Tulsa*

The manufacture of bright stock by the contact process is very generally known, and is used with stocks varying through wide specifications. The steam refined stock, after acid treatment, is not neutralized before applying the decolorizing agent, as is the case in the percolating method.

To determine the effect of free acid in the treated stock with respect to the decolorizing and neutralizing value of the clay is the purpose of this series of tests. The steam refined stock was produced continuously in a battery of seven stills from an Oklahoma green crude of the following characteristics:

Gravity °A.P.I.	38.5
Color, in ¼-in. Lovibond cell in 10 per cent water-white naphtha solution	100.0
Basic sediment and water	Trace only

This crude produced 19 per cent steam refined stock which tested as follows:

Gravity, °A.P.I.	21 5
Flash, °F.	525
Fire, °F.	605
Viscosity, at 210° F.	205
Pour, °F.	35–65
Carbon residue, per cen.	4 0
Color, in ¼-in. Lovibond cell in 10 per cent water-white naphtha solution	600
Tar (Holde method), per cent	0.4

Acid treating is the next step involved in the manufacture of bright stock, and sulphuric acid is universally used. This is a source of endless trouble and expense. There are almost as many different procedures of treating as there are refineries handling acid treated stocks.

Temperature, gravity, and strength of acid, number of "dumps," quantity of oil treated, time of blowing, settling time, etc., vary as the steam refined stock varies, and the subsequent method of finishing to bright stock. Some stocks can most economically be treated with 66 Baume acid, while others react best to 98 per cent acid. In some stocks, the reaction with 98 per cent acid is so violent that the stock boils over; consequently, a weaker acid only can be used. In general, with 98 per cent acid, the loss due to sludge is much greater; but a lighter colored acid treated oil can be obtained which requires less clay to make a given color. Generally, a more efficient treatment is obtained with a definite quantity of acid if the acid be applied in two or three dumps, settling after each application and drawing off the sludge before applying the next dump. This efficiency, however, is somewhat offset by a slight increase in sludge loss; not being due mainly to more sludge produced, but largely to the steam refined stock drawn off with the sludge in performing two or more clean "draw-offs" instead of one.

Treating Temperature Important

Temperature of treating is also of prime importance; as the lower the temperature, the more decolorizing value the acid has. Also it is advisable to treat at the lowest temperature consistent with obtaining an intimate contact between the acid and oil. There is, however, a minimum temperature for each grade of stock below which the viscosity of the oil is so great that settling is retarded (in some cases the pepper will not settle) to such an extent that part of the sludge goes back into solution, thereby losing color. This is the manner in which time is an important factor. The reaction between sulphuric acid and asphalt is not irreversible, and after a time the acid treated oil has a tendency to redissolve some of the sludge. Every treater of heavy oils, no doubt, has experienced trouble with his treat forming a "biscuit," i.e., all or part of the sludge after settling rises to the top in a foamy mass. This condition is usually met with in batches treated too hot, or when the sludge remains on the oil too long. It is possible that it is due to a secondary reaction with the liberation of gases forming a light foamy mass. At times, this mass will break and settle of itself; at other times, it becomes necessary to reblow. On the other hand, if the settling period is too short, the loss in drawing the sludge is larger; and also in contacting, the oil requires more clay to neutralize the unsettled acid and to remove the suspended sludge and pepper.

Overblowing produces oxidation with a more difficult oil to contact; while insufficient blowing is a waste of acid in that, unless the acid is thoroughly and uniformly mixed, all the acid will not enter into the reaction. This requires more acid than is necessary; or else color is sacrificed.

Treatment Determined by Trial

From this partial list of factors, one can readily see that the optimum conditions for treating a given stock can be determined only by trial and by the experience and intelligence of the treater. The best procedure on any grade of stock is to obtain intimate contact, at the lowest consistent temperature, with removal

(Continued on Page 270)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 5, 1929.

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Factors in Determination of Gum

Indications Point to the Development of Satisfactory Stability Test Based on Selective Catalysts

By C. R. Wagner and Julius Hyman
Assistant Chief Chemist and Research Chemist, the Pure Oil Co.*

ABSTRACT

Contrary to the general opinion of the uninitiated, color has little or nothing to do with gum formation in gasoline, many very yellow gasolines being gum-free while other water white samples yield large quantities of gum on evaporation. Another popular misapprehension is that gum exists as such in gasoline, but solubility and chemical tests on gum formed by evaporation show the impossibility of this. The gum-forming materials which are present in gasoline are, therefore, termed pseudo-gum to avoid confusion in nomenclature. This pseudo-gum is shown to consist largely of peroxides, per-acids, aldehydes, and ketones.

After three years' work, the authors have chosen for routine work a modification of the Smith and Cooke test for gum, in which the steam oven is replaced by an actively boiling water bath. The copper dish test is shown to be wholly unreliable. A study of the mechanism of the pseudo-gum forming reaction shows why the evaporation of large samples in contact with air gives unsatisfactory results. This reaction appears to be based on the action of an auto-catalyst, the quantity of which increases in a geometrical proportion by atmospheric oxidation.

So far no satisfactory stability test has been developed, but indications point to the development of such a method in the near future based on selective catalysts.

One of the more important problems which confronts the producers of cracked gasolines is that of gum formation. Such gasolines, if improperly refined, or if allowed to stand for long periods in contact with the atmosphere, seriously affect the operation of certain types of gasoline motors. These motors, upon investigation, show the intake valves stuck tightly and the guides clogged with a black, brittle, carbonized deposit. One speaks in such cases of the "gumming" effect of the gasoline. The analytical determination of the gum content of gasoline has for years been a controversial matter. The authors have been led to present the results of their work in the hope that they may be able to assist somewhat in clearing up the existing confusion among oil testing laboratories on this subject.

A sample of such gasoline as described just previously, when evaporated on the steam bath, leaves behind a deposit which may vary in color from a very pale amber to a brown-black, and in consistency from a brittle solid to a sticky, viscous resin. The type of gum usually met with is reddish-brown and solid—although, as the gum content in gasoline increases, the gum tends to assume a somewhat lighter color and less solid consistency. The odor of the gum resembles closely that of varnish.

Best Solvents

Once gum has been formed from gasoline, it is redissolved in it only to a comparatively slight extent. This statement may quickly be verified by dissolving 0.05 g. of gum in 1 cc. of absolute alcohol. To this concentrated solution add 20 cc. of a fresh sample of a highly cracked gasoline, and shake immediately. After shaking, it will be noticed that most of the gum has reappeared as a flocculent precipitate. On the other hand, it is not at all unusual for a 20 cc. sample of an old cracked gasoline to show 0.05 g. of gum when evaporated on the water bath or in the steam oven. Benzene acts as a somewhat better solvent, but the best solvents appear to be the ethers, alcohols, and lower organic acids. Thus, commercial ethyl alcohol dissolves gum completely.

When dissolved in alcohol or any other solvent, the color of the gum persists in the solution. This observation is of especial interest, in view of the common belief among the uninitiated that the color of a gasoline bears a direct relation to its gum content. There is no foundation in fact for this widespread notion, which seems to have sprung up with the development of liquid phase cracking processes. Decidedly yellow gasolines, for example, often show very little gum, whereas water white samples may show great quantities.

Another Misapprehension

Another misapprehension regarding gum is the terming thus of material which separates out when unsaturated gasolines are allowed to stand exposed to light and air for long periods of time. Such material appears actually to be made up of layers—a less dense, light colored, oily layer and a heavier, deep colored, viscous resin. While it is quite likely that some true gum is dissolved in both of these layers, other materials—notably peroxides—are also present. Thus, both oily and viscous layers react with an hydriodic acid solution to produce iodine; whereas this reaction does not occur with either the solid or viscous gum formed by evaporation, even though the gums have previously been dissolved and the solutions heated. Furthermore, the oily layer appears to explode when heated, a phenomenon which does not occur with true gum.

We seem, then, to be faced by a condition which has been overlooked quite generally, viz., that so-called "gummy" gasoline contains actually little or no gum in the sense of the word as applied to resins left by evaporation. The harmful constituents in old unsaturated gasoline seem, rather, to be the gum-forming materials. For the sake of clarity and brevity, we shall hereafter refer to these gum-forming materials as the "pseudo-gums" as differentiated from "residual gums," viz., the resin remaining after the gasoline has been completely driven off by heat. We feel that thus a considerable amount of misunderstanding which now exists on the subject may be overcome. For example, in their excellent paper, Voorhees and Eisinger showed that "gumming" trouble in automobile operation was traceable directly to the amount of pseudo-gum in the gasoline. Unfortunately, they use the term "preformed gum," which appelation assumes the presence of the actual gum itself.

Research and Control

Gum research and control must hinge upon a reliable quantitative method of pseudo-gum determination. Thus far no absolutely satisfactory method has to our knowledge been evolved. The best to date, we feel, is that of Smith and Cooke. These investigators suggest the evaporation, in a steam oven, of a 20 cc. gasoline sample contained in a special pyrex glass evaporating dish of 30 cc. capacity. The one disadvantage of this method for routine work is the somewhat troublesome use of the steam oven. For this reason we have modified the Smith and Cooke method by evaporating the samples on an actively boiling water bath, a very simple procedure.

The method finally arrived at is briefly as follows: 20 cc. of the gasoline to be tested is pipetted into a clean, weighed 30 cc. pyrex glass dish (50 to 52 mm. wide by 21 to 23 mm. deep), which is then placed on an actively boiling water bath so that the deepest possible immersion of the dish is obtained. There is no objection to the escape of steam around the edge of the dish, but water should not collect in the dish. After evaporation of the sample, the bottom of the dish is wiped free of water (and dirt from the bath cover); the dish is placed in an oven at 105° C. for 30 minutes; then set in a desicator to cool, and finally weighed. The increase in weight is reported as grams gum per 20 cc. of gasoline.

Water Bath Results

Water bath results, however, are always higher than steam oven results, due evidently to the oxidation which takes place in the gasoline on the water bath. So long as the pseudo-gum content is low, the numerical differences in the two methods are not great. If the pseudo-gum content is high, however, or if the gasoline sample to be evaporated is large (as it is in the copper dish test), then the gum formed by the water bath method is very much greater than the gum produced by the steam oven method. Table 1 is typical:

TABLE 1—Weight of Gums in Grams

	Sample			
	No. 1	No. 2	No. 3	No. 4
Method—				
Steam oven (20 cc. sample) ..	0.0003	0.0033	0.0115	.....
Water bath (20 cc. sample) ..	0.0009	0.0190	0.0660	0.1205
Copper dish (100 cc. sample) ..	0.1930	.....	.....	0.7500

Here one sees at once the marked unreliability of the copper dish test for gum determination as prescribed in Method 530.1, Technical Paper 323-B of the United States Bureau of Mines. The discrepancy is especially noticeable where the pseudo-gum concentration is extremely low. On the other hand, tests in our laboratories show the water bath method to give from three to six times more gum than is formed by the steam oven method. These small multiples enable one to rely upon the water bath method as an index at least of the "gumming" tendency of gasolines, and at the same time allow the routine operators to weigh larger amounts of gums, thus reducing methodical errors. We have used with satisfactory results the water bath modification of the Smith and Cooke test as a routine gum determination method during the last three years.

Definite Relation

It occurred to the authors that some definite relation might be found to exist between the mechanism of the pseudo-gum forming reaction and the ratio of the results of the water bath method to the results by the steam oven method. This ratio appears to be moderately constant, regardless of the quantity of residual gum found, although when very small amounts are present there are enough methodical errors in weighing to cause some variation in the ratio. More strangely, however, there is little difference in this ratio when great variations occur in the pseudo-gum forming tendency of various gasolines. In view of these facts, it seemed best to give serious consideration to the chemistry of residual gums and the mechanism of the reaction forming pseudo-gum.

Smith and Cooke ran a combustion analysis on residual gum, obtained—it would seem—from liquid phase cracked gasoline. We have run a combustion analysis on residual gum obtained from vapor phase cracked gasoline. The results are tabulated below (Table 2).

TABLE 2

	Smith and Cooke	Our data
Hydrogen, per cent	7.39	6.75	8.00
Carbon	69.48	70.62	73.59
Oxygen	19.93	21.06	17.17
Ash	2.78	1.00	....
Sulphur	0.28	0.50	1.24
Nitrogen	0.14	0.07	....

General Similarity

These data indicate the general similarity in the composition of residual gum, regardless of source; the empirical formula of the gums would be $(C_8H_8O)_x$. We further found an acid number of about 65 and a saponification value varying from about 250 to above 300, indicating either an ester or lactone structure for the gum. Upon heating over an open flame, residual gum gives off inflammable vapors possessing an odor reminiscent of burning rubber. The odor of the residual gum, when cold, is more or less ethereal.

If, however, gasoline containing pseudo-gum be shaken with water and the water extract evaporated on the water bath, there remains behind a brownish gummy material possessing an odor similar to that of caramel or which may smell like musty straw. Similar odors are observed when residual gum is taken up in a very little alcohol, the alcohol solution then poured into a small amount of water to form a colloidal suspension, which, after filtering to remove large particles, is evaporated on the water bath to a sticky gum. The indication in the first of these experiments points toward the direct formation of sugar and furan derivatives, while in the latter experiment the partial saponification of the esters or lactones into their acids and sugar or furan derivative alcohols is indicated. The gum formed in the first experiment dissolved in water to form a cloudy solution possessing a rather bitter and slightly sour taste. Alcohol also acted as a solvent, but ether dissolved only a small amount of the gum. With the gum formed in the latter experiment, the solubilities were reversed.

Tendency to Lose Weight

Another interesting point concerning residual gum is its tendency to lose weight upon being heated to temperatures slightly above 100° C. For example, Table 3 shows the continued loss in weight during an afternoon of two representative samples of residual gum heated to 105° C. in an electric oven.

TABLE 3—Weight in Grams

Sample No. 1	Sample No. 2
0.0266	0.0314
0.0241	0.0281
0.0204	0.0262
0.0184	0.0236
0.0178	0.0220

While the exact reason for this loss in weight has not been investigated, it appears probable that its cause is to be found in the splitting off of water from the gum complex, with the resultant formation of esters, lactones, or double bonds.

Smith and Cooke recognized the presence of aldehydes in old cracked gasolines. Brooks verified this observation, but showed that the simpler aldehydes were incapable of forming residual gums. We have found, however, that when tech-

(Continued on Page 258)

*Before tenth annual meeting, American Petroleum Institute, Chicago, December 5, 1929.

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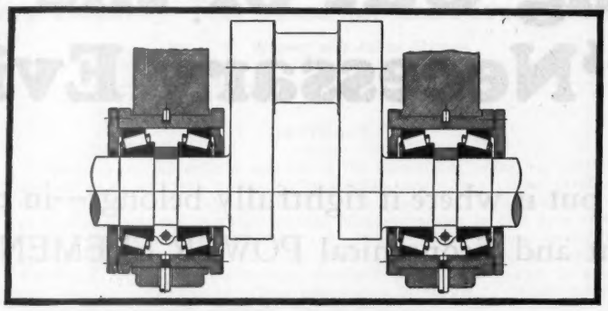

Standard 4-Bearing Mounting for Timken-Equipped Gas Engine Crankshaft.

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During the past few years there has been a big swing to Timken Bearings for gas engine crankshafts, and Timkens are now dominant at this point in 4-cycle engines, as well as on lay shafts and governor shafts. They are also being used more and more on the crankshafts of 2-cycle engines.

By mounting the crankshaft on Timken Bearings, operating efficiency and economy are greatly increased through the elimination of friction; engine life is preserved and prolonged by Timken *radial-thrust load capacity.*

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Application of Motor Truck Records

Necessity for Keeping Them, Classification Required and Importance in Control of Fleet Maintenance

By J. G. Moxey
Atlantic Refining Co., Philadelphia*

It is a well-known and recognized fact that, in order to insure successful operation of motor vehicles, it is vitally essential that some set of accurate records be kept. Without such records, the application of the fleet to the task at hand becomes a more or less blind project, groping its way in ignorance instead of one progressing successfully based on known operating data.

All concerns having to do with motor vehicles are selling some type of transportation, either to themselves or to others; and very often the failure of the fleet operation can be charged directly to the absence of an adequate accounting system.

In a recent issue (October 12, 1929) of Railway Age, the Bureau of Statistics of the Interstate Commerce Commission mentions the fact that cost accounting is not accounting at all, but rather a statistical or analytical process. This, I believe, is a very fair and good definition of the so-called cost accounting systems on which fleet operations are based. It is vitally essential that some accounting system be established, and care must be taken that sufficient attention to proper detail is embodied in the system in order to be assured of success.

Necessity for Records

The necessity of such records cannot be too strongly emphasized; in order to answer, for example, such problems as whether or not it is cheaper to hire trucks on the outside or to own and operate your own fleet. There are many companies today actually selling transportation to outsiders at a benefit not only to themselves but to the company purchasing this commodity. Careful analyses on the part of the buying company would readily establish the efficiency or lack of efficiency of such a move.

Such records within a fleet will also indicate whether or not the type of truck applied to the activity is the most economical.

In the absence of any information, a careful study of the performance of various types of machines under varying operating conditions bring about a thorough understanding and knowledge of this work, and is most efficient in assuring beyond the question of a doubt that the best results from the rolling stock are obtained and that leaks, particularly small ones, creeping into the intricacies of large fleet operation, are stopped.

Classes of Records

The many types of records existing, frequently applied to the purpose, can be set down in various classes:

Those which show only certain elements of operation, such as cost per gallon delivered of a composite fleet without any attention whatsoever to the individual performance of the individual machines applied to specific jobs. Such records may be perfectly satisfactory to the management as a whole, but, for the detailed efficient operation of the fleet, they are entirely inadequate.

Those which become so badly involved in minute detail that they can only be understood and handled by those closely connected with the operating problems. These records are not only more or less cumbersome, but absolutely useless.

Those which do not tie up to the general books of the company, therefore, do not reflect back into the business the actual cost of fleet operation. Lack of such tie-up is essentially dangerous.

And finally, those records—unfortunately in the great minority—properly devised to tie in and give the vital essentials in an accounting system for successful and economic motor transportation operation.

Essentials of Accounting

Such essentials of adequate accounting systems have been dwelt upon in numerous instances in the press; and, of course, should include first all variable charges such as oil, gas, tires, repairs, and second fixed charges such as chauffeur, license, insurance, and other miscellaneous items as garaging, bridge tolls, etc., and finally, that much-discussed item of depreciation.

In presenting this subject, it is not my purpose to deal with the classification of records; nor with the type of forms to be used, either in the field or office, for the proper collection and putting together of the final statistical statements. To make such a move, I would only be attempting to duplicate a similar work already well performed. In this connection, I would respectfully refer you to the subcommittee report of the maintenance and operation group of the Society of Automotive Engineers, presented before that body at Newark, N. J., October, 1928, by L. V. Newton, entitled "Administrative Systems and Methods," and further call your attention to the presentation before this same body just one year ago of a paper on "Motor Vehicle Cost Accounting," by our fellow member, G. R. Gwynne. No doubt these set-ups and analyses of accounting systems are already on the desks of every operating fleet manager. If not, they should be; and certainly present a clear-cut, concise treatise on the subject.

Application of Records

I will, therefore, pass to the second portion of the subject assigned: The application of a few such records to the fleet proper, both from the operation and maintenance angle.

In the treatise referred to above, it is made quite plain that any successful accounting systems must of necessity tie into some general operating unit or units. These have variously been selected for the purpose of operation, such as mile, hour, gallon, and gallon-mile. In making any comparisons, allow me to caution you that the basis must be fundamentally the same, particularly in making comparisons between your own operating performance and that of another fleet.

With the accounting system referred to as a firm foundation of truck cost, there are numerous control records prepared by us, forming the basis of successful fleet management.

The Annual Operating Statement: Shows, for the various main marketing divisions by makes and sizes of trucks, the split of the various expenses going into the operating cost of the machines, according to the headings previously referred to. This record also gives the average performance as well as unit costs, and should be continually on the desk of the fleet manager. It acts as a basis of the many studies involving trucks.

Branching off from the basic records of this statement, there are prepared from time to time special statements involving special fleet operating data, such as bulk hauling fleets, as applied in competition with rail transportation; asphalt distributor fleets, which find seasonal activity; special competitive studies of trucks of similar size but different make, and many other fundamental studies.

Cost per Gallon

Motor Tank Performance Report: Made up monthly and forwarded to each division manager showing his standing, as well as the standing of others in his marketing district. The report shows the average of the work performed by each

(Continued on Page 181)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 4, 1929.

Increasing Cost of Government

Mounting Burden Being Laid Upon Oil Industry Should Be Warning to Public of Present Trend

By Frank E. Packard
Standard Oil Co. (Indiana), Chicago.*

This is an age of government by propaganda. Before the wise and skillful use of the printed word the greatest statesmen and the most powerful governments stand helpless. In the more leisurely ages of the past, public opinion was shaped by reading and discussion. In this newer age of speed, men find time to read only and get their opinions from their favorite newspaper, and are influenced but little by their associates and local political leaders. The organization that reaches a majority of the voters, with the most plausible and convincing propaganda, controls the situation.

In such an age, an observer would expect to find the problems of government given a place of prime importance in the press. He would expect to find widely sustained and wisely conceived propaganda in favor of sane public policy and wise economic administration. On the contrary, he finds propaganda favoring political organizations and class legislation, but very little impartial, practical discussion of pressing economic governmental problems. He finds the ordinary citizen has a flair for many things, but government is not among them. It is true he rails about its high cost, its corruption, its inefficiency, its delays, its irksome restraint; but he seems to feel that he has performed his entire duty if he professes a fathomless contempt for politics and politicians. He does not appear to connect the mounting cost of government with the incompetent men he elects to office. It is a truism that the mounting burden of taxation can only be arrested by the curtailment of expenditures. It is probable that tax burdens could be reduced by one-third by business-like and economic expenditure of public funds.

Local Taxation

The discontented tax payer directs most of his criticism at the federal and state governments; while, as a matter of fact, the increasing burden of government is, in a larger part, due to the local units which function under his very nose. While the cost of these units increased from $487,000,000 in 1890 to $6,190,000,000 in 1926, the ratio of their cost to that of the state and federal government remained almost constant: 57 per cent in 1890 and 53 per cent in 1926, with an average of 55 per cent for the period. With 55 per cent of all taxes levied locally, and with extravagance and the misappropriation of public funds all but general in local governmental units, reform must begin at home if the mounting tax burdens are to be arrested.

The belief is generally current that local misgovernment is largely confined to cities. This is not true. The squandering of public moneys extends to the most isolated school districts and townships. The State Department of Education of Indiana this year rejected $70,000 worth of reference books purchased by state aid schools. In this item were sets of books by township trustees for from $60 to $70 a set, upon which book experts placed a legitimate value of from $5 to $6 a set. One township trustee bought 250 gallons of perfumed disinfectant at $2 a gallon to fumigate school houses, when a dozen fumigating candles at $10 a dozen would have been quite as effective. Excess bus costs for transporting children were found to be general, the same amount of money being paid in many instances for a two or three mile haul as were paid for a fifty mile haul. Eighty thousand dollars was cut from this item alone in rural schools receiving state aid. Teachers were hired at one price and paid at a lower figure. In one instance, the contract of a teacher called for $1,200, but a trustee reported to the state auditor that the teacher was being paid $1,600, thereby gaining $400 which could be used for some other purpose. While it is true that such conditions do not prevail in all rural localities, they are quite as prevalent as graft and extravagance in the cities.

Indirect Burden Grows

During the past 25 years, and most notably since the World War, the demand on the part of the people for governmental activity has resulted in general property and income tax burdens which have become galling. Not only have values for the purpose of general property taxation increased sharply during this period, but rates have mounted with even greater acceleration. This is most notably true of the last decade. In addition, there is a distinct and widespread tendency on the part of the states and their subdivisions to levy business and occupation taxes, and even to invoke the police powers for the purpose of raising revenue. These burdens have increased so rapidly that the oil industry, for instance, is paying to the states today in such excises an amount many times greater than the direct burden upon their property.

Municipalities have become particularly avaricious and lawless in levying these excises. They pay little regard to their conferred powers or to the state constitution in their desperate grab for revenue. Even after the courts have declared an ordinance void, they use their police force and the threat of public disfavor to compel the payment of illegal exactions. It is my belief that within a short time,

(Continued on Page 248)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 4, 1929.

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Below is shown application of Barrett Pipe Enamel by the revolving pipe method—no air or moisture will penetrate this homogeneous film for many years to come.

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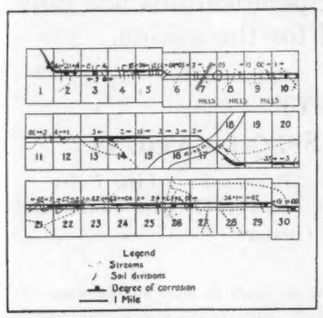
Test Causes of Pipe Line Currents

Corrosion Under Circumstances Which Preclude Possibility of Stray Current Electrolysis. Earth Currents and Soil Conditions

By K. H. Logan[1], Walter Rogers[2] and J. F. Putnam[3]*

Prior to 1920, it was generally believed by owners of pipe lines that, with the exception of unusual cases, serious corrosion of buried pipe lines was always the result of stray currents from electric railways. A little later, it was shown that in a number of localities serious corrosion occurs on buried pipe under circumstances which preclude the possibility of stray current electrolysis. This type of corrosion was attributed to the soil, and there followed a series of attempts to relate soil conditions to pipe line corrosion.

Since stray current electroylsis might exist in many localities, it is advisable in starting a study of pipe line corrosion to determine whether such stray currents are affecting the line under consideration. In starting one study of pipe line corrosion, one of the authors found that there was a small current on the line, but that the current did not have



Data on 30 Miles of Pipe Line.

Figure 1.

the characteristics of those caused by electric railways; and upon inquiry it was found that there were no electrical power stations within many miles. Subsequent pipe line studies showed that other lines carried similar currents. It is the purpose of this paper to describe some of the studies of these currents, which, for lack of a better name, we have designated as pipe line currents.

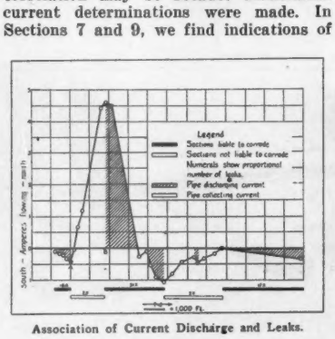
Current Discharge and Corrosion

The first series of measurements of these currents with which any of the authors have been concerned was made in connection with a study of corrosion of one of the Marland Oil Co.'s lines carried out with the co-operation of Dr. C. T. Langford and his associates. The character of the currents found on part of this line has been previously reported. Since that report, work has been done on several lines in other parts of the country and a broader view of the phenomena obtained. It is of interest to compare the results of this early work with data obtained later. Figure 1 shows the relation of the current on the line to the condition of the line as reported by Doctor Langford, when the line was removed from the ground a few months after the electrical measurements had been made by his associates. Prior to the tests, the line had been disconnected from all other lines and structures. The distance to the nearest electric railway line was over 30 miles. At any one location, the potential difference between two points was observed for not more than a few minutes at a time; but, since measurements were made one after another throughout several days, it is scarcely possible that fluctuations such as are characteristic of street railway currents would have occurred unnoticed. No such fluctuations were observed, and this and other considerations led us to believe that the currents did not originate in an electrical power station.

The significance of the data shown in Figure 1 can only be determined by rather detailed study of the drawing. The currents in amperes as computed from the potential difference measurements are indicated. The arrows in front of the figures show the direction of the flow of the current. The relative amount of corrosion is roughly shown by the thickness of the line. The points of maximum line thickness indicate locations where sections of the line were replaced on account of leaks. The lines drawn normal to the pipe line are section lines, and the distance between them represents 1 mile. Streams and hills are also indicated. The line ran approximately north and south.

Differ in Magnitude

Starting the examination of the line at Section 2, we note that the currents at different points along the line differ in magnitude. It is also seen that the currents at the two points of maximum corrosion are somewhat smaller than those on either side. This indicates that the pipe discharged current at or near the points of maximum corrosion, or in other words the pipe was anodic at these points. Sections 3, 5, 10, 12, 15, 20, 22, 23, 24 and 28 also indicate discharge of current in the regions where the corrosion of the pipe line was above the average. The measurements near any one corroded section are too few to justify any positive statement as to the relation between the two phenomena. The diagram indicates locations of corrosion without current discharge in Sections 13, 14, 25, and 26, although this lack of correlation may be because insufficient current determinations were made. In Sections 7 and 9, we find indications of



Association of Current Discharge and Leaks.

Figure 2.

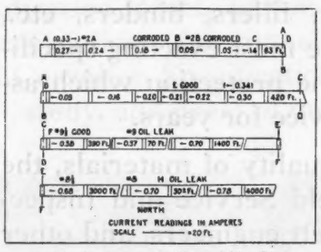
current discharge without recorded corrosion. While the data are admittedly inconclusive, it seems to the authors that, on the whole, they tend to indicate a relation between discharge of current and corrosion.

About a year after the work on the Marland line, some electrical measurements were made on a line of the Standard Oil Co. of California, and later correlated with the corrosion record of this line. The results are shown in Figure 2.

Diagram Explained

To understand the diagram, it is necessary to keep in mind the direction of the flow and the change in magnitude of the current. Thus, the first cross-hatched area lies below a section of the pipe along which the current flowed toward the south and decreased in magnitude along the line from north to south. This means the pipe discharged current along the cross-hatched section. The solid section from A to B indicates that, starting at A and traveling northward, we find a decreasing current, a reversal, and then an increase in current which reaches a maximum at the point B. Between A and B, the pipe is collecting current. The remainder of the diagram is interpreted similarly. The graphs below the line show the corrosion as indicated in the record of leaks. The apparent relation between discharge of current and leaks seems rather remarkable.

In neither of the investigations described above was it possible to make an accurate correlation between discharge of current and corrosion, because the places where current was discharged could be located only approximately, and because the extent of the corrosion was not determined with precision. In one case, the corrosion was estimated from the appearance of the pipe after removal, and in the other from the leak record. It is not claimed that a relation between corrosion and current discharge



Details of Current on 2 Miles of Pipe Line.

Figure 3.

is proved, but such a relation is certainly suggested by the figures presented.

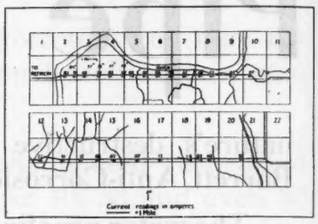
Characteristics of Pipe Line Currents

Since the pipe lines which have been referred to are remote from electric railways, it may be of interest to study the characteristics of the currents in order to obtain an explanation of their origin. One of the most noticeable characteristics of the currents under discussion is their frequent change in magnitude and direction at different points along the line. This is illustrated in Figure 3, which is a modification of a figure in the report by Logan, Langford and Athy previously referred to, and a more detailed study of conditions in Sections 1 and 2, Figure 1. The vertical lines, Figure 3, represent collars joining the pipe lengths. The gradual change in the magnitude of the current from pipe section to pipe section should be noted. The apparent relation of the currents on adjacent pipe sections is of value in estimating the reliability and accuracy of the measurements.

Currents and Topography

It has frequently been said that maximum corrosion is to be expected in regions of maximum soil moisture. Some scientists have also suggested that we should also expect that current on pipe lines flow from dryer to more moist soils. Sections 2, 4, 10, 12, 13 and 22, Figure 1, seem to indicate in a general way maximum corrosion in the region of streams, and in most of these sections a flow of current toward the stream. In Section 7, we find a discharge of current in or near a stream bed without indicated corrosion; and Sections 13, 14, 29, and 30 show marked corrosion in the low area with current flowing from the stream instead of toward it. In Sections 1, 3, 5, and 24, corrosion is indicated at points at considerable distances from streams or low ground.

Fifteen reversals of current in a distance of 26 miles are indicated in the diagram, and it is quite possible that other reversals would have been discovered if the current readings had been taken at shorter space intervals. Figure 4 shows roughly the relation between topography and the currents on a line running east and west in Oklahoma. This



Currents on 4" Pipe Line

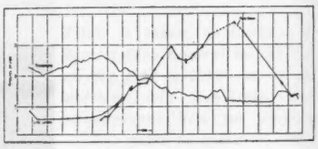
Figure 4.

line was not examined for corrosion. Starting with Section 4 and going west, we find the current flowing west and increasing toward the river. In Section 4, the current reverses and flows toward the stream shown in Section 5. Current appears also to flow toward streams in Sections 12 and 15, but away from the streams in Sections 7, 9, 18, and 19.

Currents and Streams

While the data shown in Figures 1 and 4 show several instances of flow of current toward streams, about as many cases of flow from streams are recorded; and it appears that while conditions in the neighborhood of streams may give rise to currents in some instances, there must be other causes which are responsible for the current at other locations.

Figure 5 is another study of the relation of pipe line currents to topography. The curve without arrows shows the profile of approximately 3 miles of oil line in eastern Texas, while the line accompanied by arrows shows the magnitude and direction of the current on this line. Along one section of the line, read-



Line Current and Topography.

Figure 5.

ings were taken on two days. This is indicated by the double line, and shows how nearly observations can be checked.

At only one point was a discharge of current found where a leak had occurred. At only one stream crossing does there appear to be a loss of current and no leaks have occurred at this point. Corrosion along this line is not very serious.

Relation of Currents to Pumping Stations

An interesting point to be noted in Figure 5 is that the current flows toward the pumping station on both sides. This is a phenomenon which has been noticed at other pump stations, and is shown in more detail in the next illustration.

Figure 6 shows the measurements made at the pump station indicated in Figure 5. Five oil lines enter the section from the south, three from the north, two oil lines and one water line from the east, and two oil lines from the west. The arrows indicate that current flows to-

(Continued on Page 250)

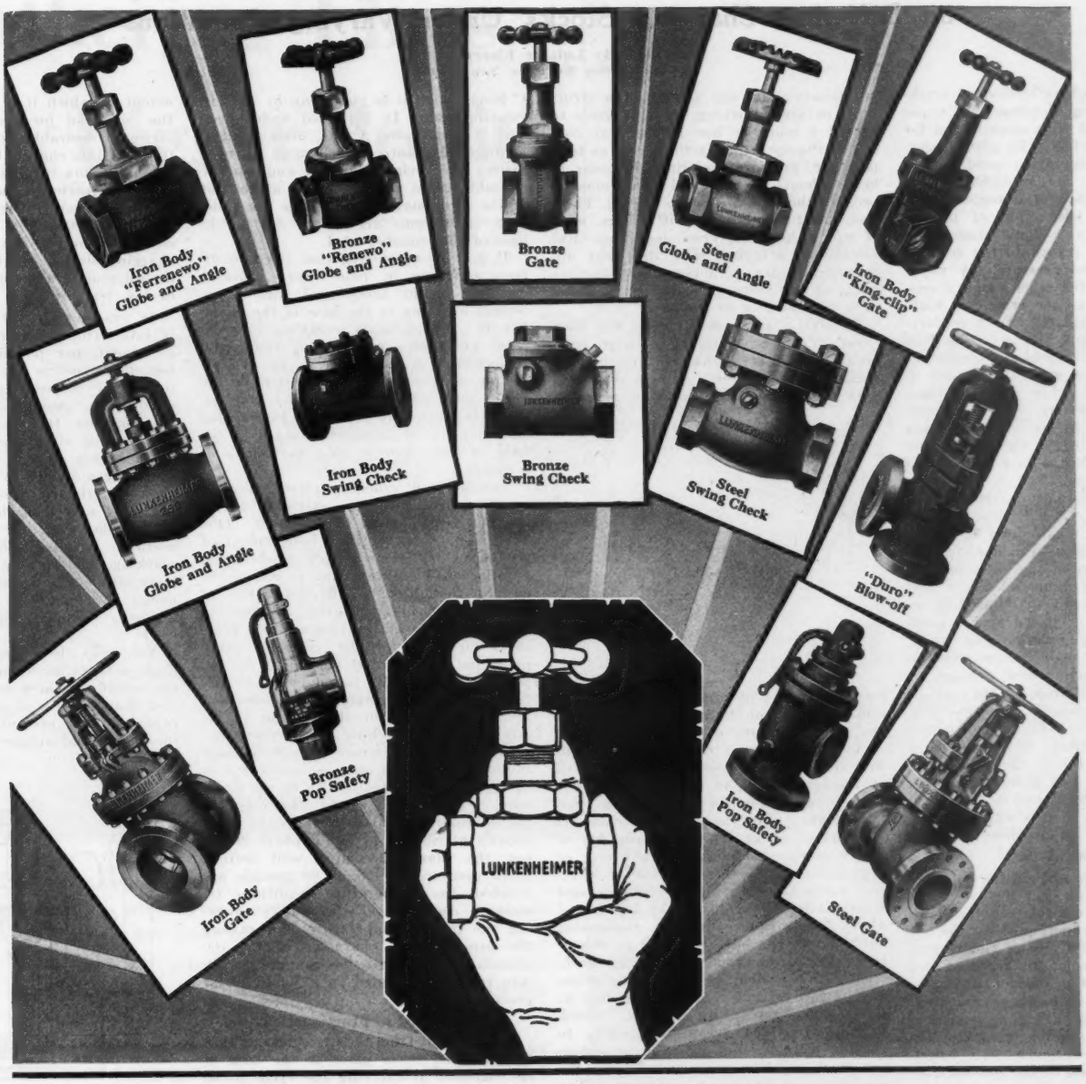
*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December. 5, 1929. Publication approved by Director United States Bureau of Standards (Department of Commerce).

[1]In charge of Bureau of Standards Soil Corrosion Investigation, Washington, D. C.

[2]Gulf Pipe Line Co., Houston, Tex.

[3]Standard Oil Co. of California, San Francisco, Calif.

Note—The authors wish to acknowledge assistance received from G. N. Scott, S. Ewing, S. Gill, W. Brock and R. Teplitz



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New Type of Cracking Unit Described

Said to Be Feasible to Install Process to Operate Effectually on Differing Charging Stocks Under Varying Conditions

By Luis de Florez
Consulting Engineer, New York*

The customary classification of cracking in terms of liquid phase and vapor phase has persisted with more regard for tradition than for fact. In actual practice, a cracking operation producing a gasoline bearing a resemblance to straightrun products and accompanied by a relatively low production of process gas, is referred to as a liquid phase process without much regard to the relation of temperature and pressure. A vapor phase process, on the other hand, is customarily regarded as one producing highly unsaturated distillates and a relatively large proportion of gas. Common usage designates cracking operations more in accordance with the nature of the ultimate results than with the characteristics of processing, and thus tends to maintain the existence of a confusing and arbitrary line in the wide borderland which links so-called liquid phase and vapor phase cracking.

A survey of existing practice reveals the interesting fact that products attributed to liquid phase and to vapor phase cracking can be produced within a temperature range of the order of 200° F. and a pressure range of about 300 pounds per square inch. Inasmuch as the characteristics exhibited by the products of a cracking operation are fundamentally dependent upon the temperature and the density maintained during the reaction time, limitation of the use of equipment to one class of operation does not seem justified. This consideration suggests the possibility of developing a cracking unit in which the factors of temperature, time, and pressure can be varied sufficiently to extend its operation to the manufacture of products of either the liquid phase or vapor phase type.

Antiknock Values

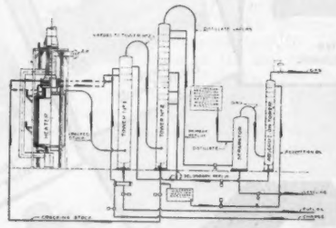
The desirability of such a development is evident. Cracking in the so-called liquid phase, at comparatively low temperatures, has been perfected as the result of a vast expenditure of energy and money, and has become an accepted and necessary means of manufacturing gasoline. So-called vapor phase cracking, on the other hand, at higher temperatures and generally lower pressures, has been considered, heretofore, less suited to the economic needs of the industry, in view of the relatively large productions of noncondensable products which attend such processing. Under ordinary circumstances, it cannot compete in efficiency as a gasoline process, but has received commercial consideration chiefly for the production of its antiknock values to meet the growing demand for them in modern gasolines. It is recognized that vapor phase cracking has merit, but the industry has been reluctant to commit itself to large expenditures for highly specialized equipment, when the ability of such equipment to compete with standard processing requires the consideration of variable conditions such as: the market for the gas produced, the demand for antiknock gasoline at a premium, and the absence of crudes with high natural antiknock values.

The advent of equipment capable of a wide range of results would permit commercial experiments with other operating methods without the financial hazard, thus removing one of the chief obstacles to progress in extending the usefulness of cracking to fields which are not limited solely to the manufacture of antiknock products.

Control of Factors

The problems involved in the design of a cracking unit capable of a wide range of operation are not merely of a structural nature; provision must be made to permit a more or less independent control of the operating factors, such as temperature, pressure and time, in order to bring about the required conditions to produce the type of results desired. These problems present many difficulties, none of which, however, precludes a practical solution if attacked with the clear understanding that cracking at various parts of the scale differs more in detail than in theory of processing.

A solution to these problems has been found in the evolution of a design combining certain structural features and an operating cycle which can be balanced with widely differing rates of cracking



TYPICAL FLOW DIAGRAM

per pass. The discussion of this design and its reduction to practice constitutes the subject matter of this paper.

A cracking unit, embodying most of the characteristics sought, was erected at Bayonne, N. J., in 1927, and has now been in operation for a little less than two years. The unit has a charging capacity of about 1,000 bbls. per day of heavy crude, and comprises a heater of approximately 1,500 square feet of effective surface, an expansion chamber and fractionating tower 43 feet by 4 feet, and about 2,000 square feet of condensing surface. It has been operated principally on Venezuela crude as charging stock, with a few periods of gas oil operation. Up to the present it has functioned at the higher temperature ranges, which usually offer the greatest difficulty to continuous operation with heavy charging stock and the most promise for the production of antiknock distillates. The effect of varying temperatures and pressures has been studied, and it is proposed to continue the study of results, not only under extreme operating conditions but in the intermediate ranges as well. Obtaining reliable data involves long periods of operation under given conditions, which necessarily lengthens the task of research in the field of processing. The adaptability and efficiency of the equipment, however, has proved successful beyond expectation, and has led to the construction of other similar units whose operation will shortly afford additional sources for commercial data to supplement the existing work.

Operating Cycle

The operating cycle of the unit is broadly illustrated in the accompanying figure, where A represents the heater, B a combined expansion chamber and fractionator, C an accumulator tank, and D a circulating pump for cycle stock. The charge enters the expansion chamber at E, where it comes in contact with the products discharged from the heater A, which enter the expansion chamber at F. The charge is heated by the products entering at F, and subjected to a cracking distillation which causes the light vapors and recycle stock to ascend into the fractionator. The cycle stock is drawn off at an intermediate point G above the charge inlet, passing into tank C from which it is picked up by the circulating pump D, delivered under pressure to the heater A and, after heating, is discharged into the chamber B, completing the cycle. Naphtha and noncondensable gases are drawn off at the top of the fractionator at H, while the residuum or bottoms are drawn off at the base of the chamber at J.

It may be considered that the unit affects cracking in two ways: primary cracking in the heater coil, and a secondary cracking in the base of the chamber B. The primary cracking is regulated by raising or lowering the outlet temperature of the heater, or by increasing or decreasing the circulation of the cycle stock. The secondary cracking, on the other hand, is regulated by varying the quantity of products retained in the base of the chamber and variations of pressure.

The over-all cracking effect may be modified by the relative extent of cracking in the coil or in the chamber. One is, of course, not entirely independent of the other, but their proper combination permits sufficient variation to obtain the desired flexibility in the formation of various kinds of products. When operating at high temperature and low pressure, virtually all the cracking takes place in the coil and, as might be expected, the resulting products are of the type attributed to vapor phase operation. As the pressure on the system is increased, more cracking can be accomplished in the chamber without coking, the effect of which becomes noticeable in the breaking of the viscosity of the residuum. Concurrently, the character of the distillate changes toward the type usually attributed to liquid phase cracking, the change becoming well defined when pressures of 50 or 60 pounds are reached, the temperature conditions remaining constant. By gradually lowering the heater temperature and raising the pressure, the character of the operation can gradually be changed to obtain results attributed to a liquid phase process.

Subjected to Fractionation

It is evident from the arrangement that a separation takes place in the base of the chamber B carrying the cycle stock, gasoline and noncondensable gas overhead, leaving the carbon-bearing residual products in the base of the chamber from which they may be drawn off at will. The cycle stock, which is composed of distilled charge and products requiring further cracking, is subjected to fractionation through bubble trays to eliminate any material which might deposit upon vaporization. This feature is requisite to high temperature operations and extremely desirable for low temperature work, as it permits the heater to function at all required temperatures almost indefinitely without the necessity of cleaning. The arrangement also permits subjecting the heavier portions of any type of charging stock to whatever extent of cracking may be desired, without recourse to the high pressures normally required when such products are cracked in a pipe coil.

The cycle stock is not only cracked by its passage through the heater, but also serves as a carrier of heat to effect the distillation and cracking in chamber B. The heat requirements at this point obviously vary with the grade of charging stock, and the extent of the distillation and cracking to be performed. The heat requirement is balanced roughly by the temperature of the heater discharge and the rate of circulation established.

The extent to which these factors can be varied is somewhat limited by the extent to which it is desired to crack in the coil, and for practical operation it is found desirable to vary the temperature of the charge by preheat and to employ reflux to obtain an accurate balance. Experience has shown that this balance is not difficult to obtain, and that the permissible variation is quite sufficient to take care of any class of charging stocks, ranging from gas oil to topped crudes, and for operations at high or low temperatures.

In cracking at very low pressures, it is interesting to note that the heat requirement, per pound of charge to the heater, is nearly double that required for usual pressure operations. Consequently the amount of heat delivered to the chamber B is considerably greater per unit of circulation. It is found to be in excess of that required for operation on gas oil, which means that cooling must be effected, resulting in a loss of heat. If topped crude is charged to the system, however, this heat is employed usefully in distillation and secondary cracking, making the process thermally more efficient, reducing the heat requirements to about the same figure as is normally found in ordinary pressure still work.

Numerous heat balances have been made with different operating conditions, the result of which points clearly to the fact that the use of gas oil in high temperature, low pressure treatment is an inherent disadvantage thermally. Many

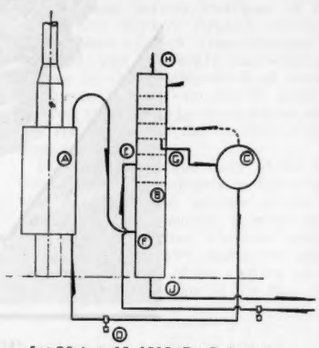


DIAGRAM OF OPERATING CYCLE
DEFLOREZ CRACKING UNIT

schemes for heat exchange are possible, of course, but none can compare in simplicity to the utilization of excess heat by direct contact with heavy products to perform useful work. This fact, taken in conjunction with the relative lower market price of heavy charging stock, clearly points to their desirability for treatment in this manner.

Typical Flow Diagram

The Bayonne unit, which has been used to determine the characteristics of operation of the cycle, was purposely made extremely simple, and when first constructed was not provided with heat exchangers or adequate gas recovery equipment. These features have been added to the design of units now under construction and incorporated in the typical flow diagram, which illustrates diagrammatically the physical arrangement of the equipment. This arrangement is virtually the same as the Bayonne unit with the exception of the chamber and fractionator, which have been separated into two towers for structural reasons, and the features mentioned added.

As shown the unit comprises a vertical tube heating element, a primary tower providing an expansion chamber

(Continued on Page 246)

*Before tenth annual meeting American Petroleum Institute, Chicago, Ill., December 4, 1929.

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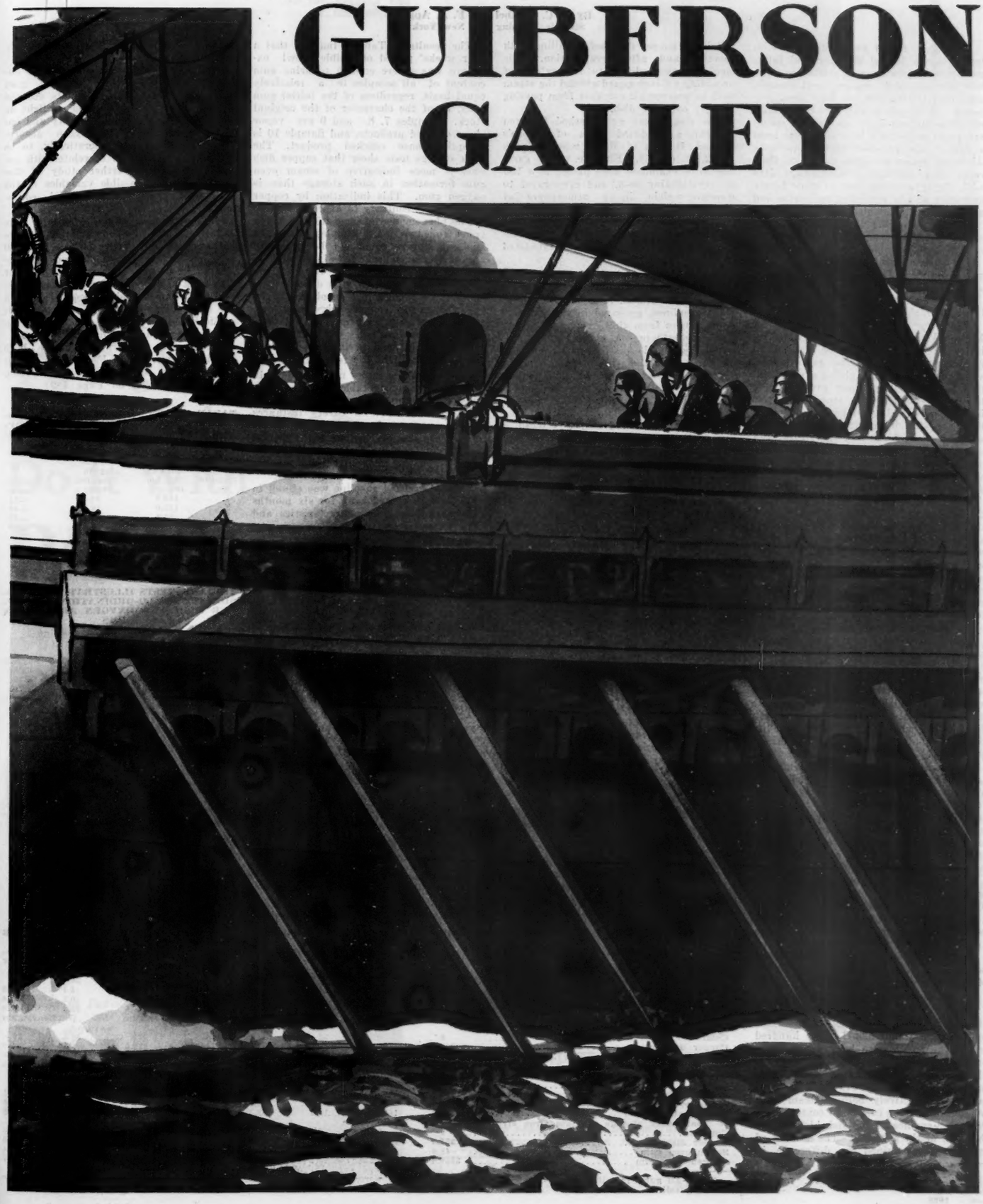

Some Phenomena of Gum Determinations

Tests for Preformed or Actual Gum Existing in Gasoline and Potential Gum Forming Tendency Inherent in Gasoline

By E. C. Herthel and F. A. Apgar
Sinclair Refining Co., New York*

With the recent and widespread interest shown in the meaning and interpretation of gum tests as related to gasoline storage and engine performance, numerous testing methods have been proposed. It is safe to say that most refiners of petroleum have adopted as standard practice in their laboratories at least a few of the proposed testing methods. Although somewhat dubious as to their value, they continue to accumulate data with the expectation that at some future date they will be proved of real value and given a definite significance.

Briefly reviewing the situation as it stands today, it might be said that attempts have been made to determine:

1. The so-called preformed or actual gum existing in gasoline at a given time, and
2. The potential gum-forming tendency inherent in the gasoline.

The very excellent research work of Messrs. Voorhees and Eisinger, in correlating so-called preformed or steam oven gum content with engine performance, stands out as possibly giving a real solution to the first of these problems. If the gum deposited in a steam oven test is not so-called preformed gum but rather, as has been suggested, a condensation product formed by the steam oven test conditions, the addition of gum-forming deterrents may upset the correlation of steam oven gums with engine performance.

The second problem, that of estimating the extent to which actual gum formation will take place under long time storage conditions, is by nature very much more complex than the first problem, and is the one which has given rise to this present discussion. The discussion is incomplete, but is presented to make available points considered of general interest.

Oxygen Absorption Method

The controlled oxygen absorption method has been suggested for a measure of potential gum. This method has been used in the study of gasoline characteristics, in conjunction with the steam oven method which measures the so-called preformed gum, and also with the copper dish method which may measure both the potential gum and so-called preformed gum.

In this study, the oxygen gum method used was substantially that described by Voorhees and Eisinger, viz., oxidizing 25 cc. of gasoline sample in a 500 cc. glass container filled with oxygen, rubber stoppered and immersed in a water bath at boiling temperature for five hours, cooling, decanting into a 150 cc. crystallizing dish, together with alcohol and benzol washings, and evaporating to constant weight in a steam atmosphere held at 325-340° F. The residue is calculated on a basis of 100 cc. of gasoline. The only possible divergence from the Voorhees and Eisinger method was that of adding a metal clamp to secure the rubber stopper in place, thereby assuring prevention of leakage of oxygen.

Copper Dish Gum Method

The copper dish gum method was slightly modified from method described in Technical Paper 323-B. One hundred cc. of the gasoline to be examined was placed in a freshly polished hemispherical dish of spun copper, approximately 3½ inches in diameter, and evaporated to dryness on an actively boiling steam bath without any steam coming in contact with the outer surface of the dish higher than the level of the gasoline. The amount of gum was determined by difference in weight of copper dish before filling with gasoline and after evaporation. This method was modified to the extent of providing a 6-inch guard around the steam bath to prevent air currents from passing directly over the dish.

The steam oven gum method followed utilized a modified form of Cooke's method, Bureau of Mines report, Series No. 2,686 (1925). Fifty cc. of the gasoline to be examined were placed in a 150 cc. crystallizing dish, and evaporated to constant weight in an atmosphere of steam held between 325-340° F.

The impossible co-ordination of copper dish and oxygen absorption gums is indicated in characteristic results tabulated in Tables 1 and 2.

Further proof of lack of co-ordination of copper dish and oxygen absorption gum is given in gum tests on like boiling point gasolines, prepared in three different manners from the same vapor phase cracked distillate. A blank sample prepared by simple distillation through a laboratory fractionating column showed 1,000 milligrams by copper dish method and 1,600 milligrams by oxygen absorption method. A gasoline produced by simple distillation of the yellow naphtha after treating method No. 1 showed a copper dish gum of 1,054 milligrams and an oxygen absorption gum of 128 milligrams. A gasoline produced by simple distillation after treatment of vapor phase distillate by method No. 2 showed 1,001 milligrams of copper dish gum and 4 milligrams of oxygen absorption gum.

Catalytic Effect of Copper

These results may be explained by catalytic effect of copper causing the high copper dish gum. It was suggested that trial be made of the effect of copper, and also of steel, both upon the oxygen digestion stage and upon the steam oven evaporation stage of the regular oxygen absorption method. A few of the results of such combinations are given in Table 3. The data, although not extensive, bring out the important point that metals do play a strong role in catalyzing oxidation reactions of this nature, steel being less active than copper.

The effect of metals is also brought out in four weeks storage tests, made on samples 7, 8, 9, and 10. The tests were made in gallon glass containers vented to air under the following conditions:

1. Exposed to sunlight.
2. In dark.
3. In dark, with additions of copper strips.
4. In dark, with addition of steel strips.

The storage with steel and copper gives instances of acceleration in formation of steam oven and oxygen absorption gum, the copper showing greater activity. These data are shown in Table 4.

The results in Table 4 indicate that a four weeks' period of visible bowl exposure was severe enough to bring gum content of all samples to a relatively equal basis, regardless of the initial gum tests, or of the character of the original stock. Samples 7, 8, and 9 are vapor phase cracked products, and Sample 10 is a liquid phase cracked product. The dark storage tests show that copper dish gum is more indicative of steam oven gum formation in such storage than is oxygen gum. This indication by copper dish gums is contrary to expectations.

The phenomenon of deposition of heavy gums from two of the samples exposed to sunlight storage could not be traced to any particular cause. It is interesting to note in this connection the results given in Table 5 which show gum deposit from treated straightrun gasoline, even though gums by copper dish, steam oven and oxygen absorption methods on original samples are all very low. The samples used for data in Table 5 were exposed to sunlight for four days.

Although the samples used for data in Table 4 show considerable change of color on sun exposure, along with increase of gum content, Table 6 covers instances where exposure of treated liquid phase cracked gasoline over a four weeks' period caused gum content to be materially increased and the color to be changed but slightly.

Treated cracked gasoline was stored in a 15,000-bbl. vented tank for six months with change in gum characteristics and color as follows:

	Copper dish	Steam oven	Oxygen absorption	color
Before ..	33 mg.	0.2 mg.	30.6 mg.	30+
After ..	45 mg.	2.0 mg.	20.4 mg.	+29

A sample of the gasoline after storage was exposed to 27 hours of good sunlight in a vented five-gallon glass bottle, and the gum and color tests on it after exposure were as follows:

Copper dish gum	72.7
Oxygen gum	144.0
Steam oven gum	26.0
Color	0

After Sun Exposure

The sample after sun exposure showed gum deposit when used in an automobile engine, whereas another sample taken after storage, but without sun exposure, showed no gum deposit when similarly used.

The foregoing shows the variations encountered with the three general gum testing methods, and also points out the factor of metal contact and sunlight as agents affecting storage stability and engine performance. The oxygen absorption method seemed, theoretically, to be the logical method to correlate with potential gum, and further study of this method and of possible variables in the same was carried on in special equipment.

The apparatus was essentially as shown in Figure 1—constant temperature bath, manometer, oxygen burette, and 500 cc. flask equipped with stopcock connection. The 500 cc. flask was of the short ring neck variety in order to permit placing the stopper and stopcocks close to the bath. This avoided to a large extent condensation in these regions and its influence on volume readings.

Due to the temperature of the bath varying between 211° F. and 215° F., it was necessary to choose a definite period

(Continued on Page 189)

TABLE 1—TESTS ILLUSTRATING IMPOSSIBILITY OF CO-ORDINATION OF COPPER DISH GUMS AND OXYGEN ABSORPTION GUMS

	Liquid phase cracked gasoline		
Sample No.	Copper dish gum (mg. per 100 cc.)	Oxygen gum (mg. per 100 cc.)	Saybolt color
1	163.8	32.2	+11
2	125.0	16.8	+10
3	11.1	1.6	+29
4	190.9	8.0	+29
5	73.6	1.0	30+
6	8.0	99.2	+23
7	3.3	17.2	+30
8	9.2	17.6	+30
9	8.0	40.0	+29

TABLE 2—TESTS ILLUSTRATING IMPOSSIBILITY OF CO-ORDINATION OF COPPER DISH AND OXYGEN ABSORPTION GUMS

	Vapor phase cracked gasoline		
Sample No.	Copper dish gum (mg. per 100 cc.)	Oxygen gum (mg. per 100 cc.)	Saybolt color
1	341.5	1.0	26
2	15.9	1.2	23
3	699.6	12.4	17
4	37.8	4.4	28
5	35.6	1.6	19
6	39.1	1583.0	+12
7	40.7	696.4	4
8	32.2	1214.4	30
9	20.6	89.6	+24

TABLE 3—EFFECT OF METALS ON GUM TESTS

Sample No.—	14 mg. per 100 cc.	15 mg. per 100 cc.	16 mg. per 100 cc.	17 mg. per 100 cc.	18 mg. per 100 cc.
Oxygen absorption test (regular)	7.6	24.8	14.0	194.8	24.8
Oxygen absorption test with metal in oxidation phase:					
Copper (partial immersion)	2729.6	2377.6	..	1120.8	37.6
Copper (total immersion)	..	..	622.6	1185.6	49.6
Steel	1610.8	1555.2	..	..	..
Oxygen absorption test with metal dishes in reduction phase:					
Copper dish	9.6	22.0	..	..	..
Steel dish*	50.4	—0.0	..	..	..

*Not reliable due to scaling of steel dish.

TABLE 4—BEHAVIOR OF VAPOR PHASE AND LIQUID PHASE CRACKED GASOLINE IN STORAGE WITH METALS AND THEIR VISIBLE BOWL TESTS

Sample No.	7 Before	7 After	8 Before	8 After	9 Before	9 After	10 Before	10 After
One month visible bowl:								
Color	0	0	22	0	+26	16	30+	19
Copper dish gum	959.9	3638.4	84.8	173.1	553.0	236.6	3.1	1151.6
Steam oven gum	41.6	1560.0	6.2	1100.0	4.4	1242.2	0.2	453.4
Oxygen abs. gum	3256.4	4980.0	13.2	3102.0	758.8	3831.6	19.2	1440.0
Gum deposit	..	None	..	None	..	heavy gum	..	heavy gum
One month dark storage in glass:								
Color	0	0	22	10	+26	23	30+	30+
Copper dish gum	959.9	1217.0	84.8	77.6	553.0	333.5	3.1	3.0
Steam oven gum	41.6	43.2	6.2	19.2	4.4	67.8	0.2	4.6
Oxygen abs. gum	3256.4	2910.0	13.2	15.2	758.8	1506.8	19.2	0.8
One month dark storage in glass (copper strip):								
Color	0	0	22	0	+26	13	30+	28
Copper dish gum	959.9	2889.3	84.8	132.5	553.0	1150.5	3.1	9.1
Steam oven gum	41.6	..	6.2	49.6	4.4	437.0	0.2	4.8
Oxygen abs. gum	3256.4	1016.0	13.2	168.0	758.8	1898.8	19.2	176.8
One month dark storage in glass (iron strip):								
Color	0	0	22	12	+26	14	30+	30+
Copper dish gum	959.9	1312.1	84.8	85.0	553.0	682.5	3.1	4.0
Steam oven gum	41.6	46.6	6.2	..	4.4	85.4	0.2	6.4
Oxygen abs. gum	3256.4	1769.2	13.2	23.6	758.8	2097.6	19.2	42.7

Note—All gums in milligrams per 100 cc. Samples 7, 8 and 9 were vapor phase, cracked gasolines, while Sample 10 was a liquid phase cracked gasoline.

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill. December 5, 1929.

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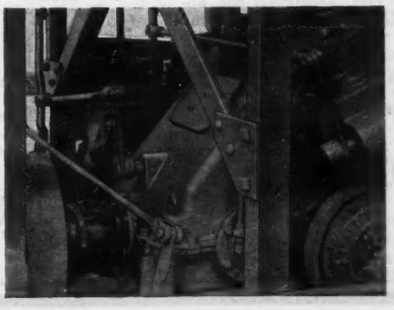
Not so long ago, engineers shook their heads over such jobs. "Nothing doing for machines. Tear 'em to pieces." But pipeline contractors had to have the speed that only machine-digging could give. The Parsons 31 was designed to handle such work and in one short year it has blazed a new trail for trenchers.

Where other machines had turned up their noses, the Parsons 31 put its nose down—and dug. Through tight places where ordinary diggers would have been helpless, the offset design of the Parsons enabled it to dig right ahead. Through rocky ground where ordinary diggers would have called for Time Out, the Parsons 31 dug job after job, sometimes working double shifts for weeks at a stretch. No wonder pipe-line contractors say, "When you must fight Time, do it with a Parsons."

Parsons builds a complete line of three offset ditchers—the 21, the 25 and the 31, for trench up to 48 inches wide and 12 feet deep—plus the Parsons 40 for extra heavy work—plus a high-speed backfiller. All of them have helped to build the Parsons reputation for handling more dirt per dollar. And all of them will live up to it on your jobs.

The Parsons Company
Newton, Iowa
Tulsa Office—805 Mayo Bldg.
Division of National Equipment Corporation



Close-up of Parsons main machinery, showing the single case that houses all driving gears — an important engineering advantage that is reflected in increased ability to stand the gaff.

PARSONS

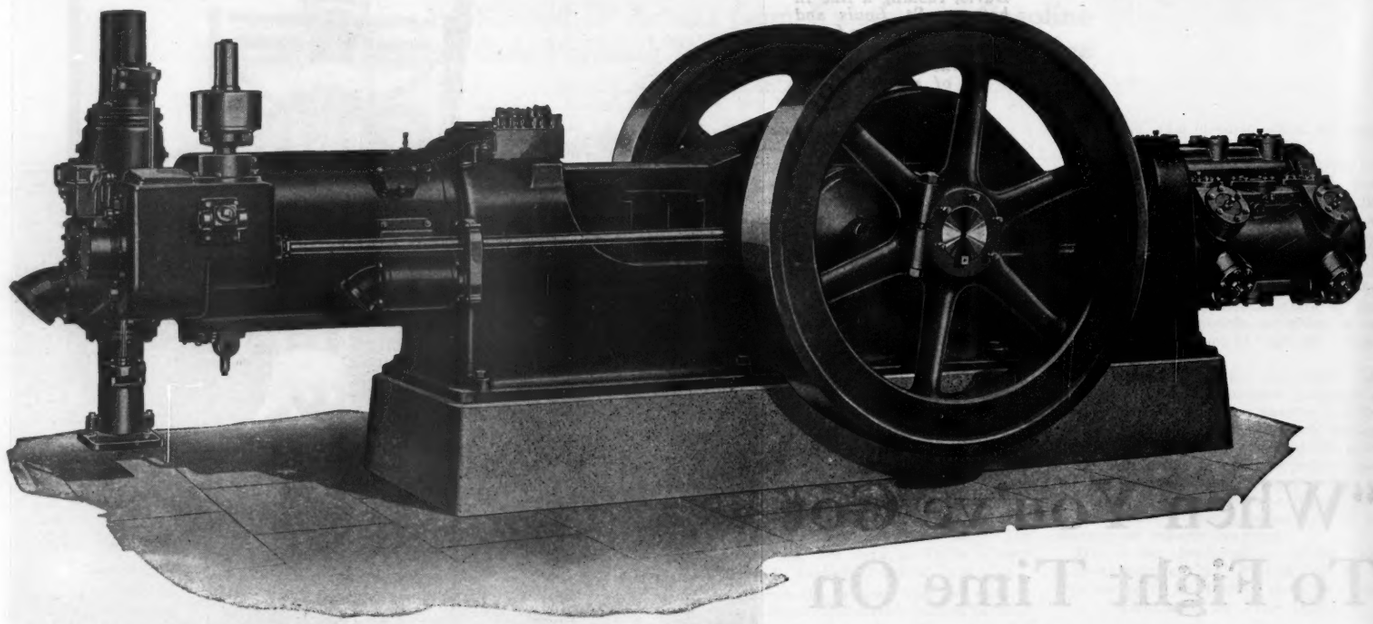
A complete line of trenchers and backfillers

OG-127

THE PARSONS COMPANY,
Newton, Iowa. ----------

Please send complete information on Parsons machines to handle trench about ..... inches wide and ..... feet deep. ----------

New Pattin Super Power



Now Fitted With Timken Bearings

THIS new 100 H.P. Direct Driven Compressor carries an Auxiliary Exhaust Valve that practically eliminates all valve trouble. It embodies features that stamp it as a unit far in advance of any heretofore offered, and it will carry the full rated horse power load.

It is a four cycle, single acting, center crank type, fully enclosed, with two fly wheels and has the following features—

Auxiliary Exhaust Valve

The main feature of our new engine is an Auxiliary Exhaust Port Sleeve Valve, (Patent applied for). It eliminates valve trouble. As practically all fire is taken out of cylinder through the center of this sleeve valve, and does not come in contact with the finished surface of the main valves, the greatest wear is eliminated. After exhaust takes place, this valve closes, and prevents loss of incoming charge or fouling by exhaust gases. No fire goes through the main valves.

Assembly of Compressor Cylinders

Each cylinder is independent of the other. The pistons or valves can be removed without changing a single pipe connection or affecting the alignment in any way.

This 100 H.P. Direct Driven Compressor is self contained—one foundation, and has no outboard bearing or supports of any kind to get out of line and cause trouble.

It has high speed governor, gear driven, enclosed; Timken Bearings, completely enclosed combination splash and force feed lubrication, and automatic air starter.

A special feature has been built into this unit, which permits it to operate on very lean air gas.

It is destined to be the sensation of 1929—write today for literature on this Super Power Unit.

Suitable for Gas Booster work—any pressure from 50 to 400 pounds.

Equipped With MEISTER VALVES

Meister Valves are made of vanadium steel and weigh less than two ounces each. On account of their lightness they are absolutely noiseless and will never require grinding.

Seats are made separate from cylinder and are readily accsesible for cleaning or repairing without removing a single connection. As they are free from troublesome springs, they can be used in any position. Here are some features of Meister Valves.

1—Improved mechanical and volumetric efficiency over the old style poppet valve.
2—Elimination of lubrication of any kind for the valve itself.
3—Silent operation at the highest piston speeds.
4—Valves never require regrinding.
5—Elimination of troublesome springs.
6—Simplification of air end, owing to the absence of all complicated valve operating mechanism.

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Water Pumps
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Cooperation Cornerstone of Progress

Address of President E. B. Reeser Reviews Record of Remarkable Activity of Institute During Past Year

By E. B. Reeser
President, American Petroleum Institute; President, Barnsdall Oil Corporation*

Co-operation is the cornerstone of power, stability, and progress.

The relations and interrelations of men and companies engaged in the same industry run through the entire fabric of its industrial life and, in certain respects, compel unity of purpose and common action.

It has been stated that even the preservation of the competitive system itself depends upon the ability of competitors to co-operate. Be that as it may, the indisputable fact remains that in some way those forces which sustain an industry must be guided by common principles; they must measure things by the same standards; they must talk the same language.

From the beginning of the modern petroleum industry, it has been under the necessity of continuing changes and readjustments. We might not unreasonably claim that petroleum is the temperamental genius of all of the great material resources that the world has yet developed. It seems somehow as though during the last generation of our industry's brief lifetime the inventive faculty of mankind had suddenly turned itself largely to devising new demands for this most versatile and precious of the earth's raw materials.

When our nation became involved in a titanic struggle—which none of that period can forget—both government and industry were agreed there must be co-operation. The petroleum industry—to its credit—determined, since co-operation was essential to war needs, that co-operation should be hearty and complete—and it was. That gave the petroleum industry its first real taste of industrial co-operation; and it liked it. The American Petroleum Institute was conceived and born.

Influence of the Institute

Ten years ago this Institute was little more than an aspiration. Now it is everywhere regarded as a large and influential business institution. Lately, more than one writer of articles about petroleum has referred to it as "one of the most powerful industrial organizations in the world."

The Institute is the instrumentality through which the larger petroleum industry policies are formulated; through which industrial standards are fashioned. These policies affect directly an invested capital of roundly eleven billion dollars. Wittingly or otherwise, the work of the Institute in most respect affects the balance sheet and the every day business life of every company engaged in the petroleum business.

Most of you know something about the Institute's activity. None of you know all about it, and but few of you realize the extent of its ramifications. In the nature of things only one individual, viz., our executive vice president, can be in possession of such a mass of data, fact and information. I have drawn freely upon his storehouse of knowledge, and your president proposes that his address today shall be a saga of the Institute—an answer to the frequent inquiry: "What does the Institute do?"

Statistics

In the formulation of oil company management, policy and procedure, statistical fact and data are essential. The statistical work of the Institute is becoming increasingly important.

Perhaps the notable single piece of information currently issued by the Institute is the newly inaugurated refinery report. The collection and publication weekly of these figures was started in June of this year. It is being referred to as the most valuable thing statistically the Institute has ever done. Companies representing more than 95 per cent of the daily operating capacity of the entire refining branch of the industry are contributing their figures and co-operating in making this report a success. It is expected that the few companies not now sending their figures will soon conclude to report them, thus making the published figures cover 100 per cent of the refinery capacity of the country. Such splendid co-operation as 100 per cent in the East Coast, Texas and Louisiana Gulf Coast areas, 98 per cent in the Indiana, Illinois, Kentucky district, 92 per cent in Texas, a little more than 97 per cent in Louisiana-Arkansas, and 98.4 per cent in California attest the degree of importance which the refining branch of the industry attaches to the assembling and publication of these refinery figures.

A committee of oil company comptrollers and experienced accountants have, during the past year, been going over and improving the charts approved in 1928, and a final report with all revisions will be submitted to the board for approval during this meeting. Every company in the business should adopt and use the A.P.I. Standard Charts and Forms when issuing balance sheets.

To protect the interest of the owner and lessee of tank car equipment and the shipper of petroleum products, the Institute represents the industry at all hearings incident to rail transportation, excepting only in the case of freight rates. An active committee of oil company traffic and transportation experts functions regularly and effectively.

The compilation of the fire records of the industry, instituted in 1926, has been continued; and, through wider support of oil companies, is rapidly becoming a substantially complete record of oil property fires. Such a record is invaluable in combating unnecessarily restrictive legislation with regard to the handling and storage of our products, and I urge a voluntary report to the Institute of all fires as soon as practicable after their occurrence. A standard fire report form, prepared for the purpose, will be furnished in any quantity on request.

The 1927 survey is a unique example of the co-operative spirit of the petroleum industry in attacking the problem of preventing the pollution of waters by oil. During this countrywide survey, 619 oil plants and 177 oil fields were inspected by voluntary representatives of the Institute, connected with more than 50 oil companies.

Refinery Technology

A general committee on refinery technology, composed of oil company technologists, has co-operated with the Federal Specifications Board in revising the federal specifications for motor fuel. The committee feels that the best interests of oil company refinery technologists would be advanced by the formation within the Institute of a division of refinery technology. Acting on the recommendation of the General Committee on Refinery Technology, the Institute has recently recognized the A.S.T.M. standard methods of testing developed by Committee D-2 through their adoption as A.P.I. standards.

Co-Operative Motor Fuel Research

The National Automobile Chamber of Commerce, the Society of Automotive Engineers, and the Institute have sponsored and financed co-operative research on motor fuel problems at the United States Bureau of Standards for several years. During 1929, the work has consisted largely of a study of volatility in its relation to starting and acceleration, and of progress toward the standardization of a method for determining the anti-knock ratings.

Corrosion

Conservative estimates place the annual cost of corrosion to the petroleum industry at $120,000,000, or over. The corrosion problem is important to the industry, not only because of the enormous waste of equipment, but also because of the accompanying hazard to life and property and losses due to interrupted operation. Consequently, it has commanded the attention of the engineers, chemists, and metallurgists of the country. The Institute, appreciating the importance of co-operation in this field, appointed, in 1928, a general committee on corrosion. A large number of oil companies not represented on the committee have designated their corrosion specialists to co-operate with the committee. In this way, the problems of every phase of the industry and of each geographical region are given proper consideration. There are two standing committees: one on refinery and marine corrosion, and the other on pipe line and production corrosion.

In the field of refinery and marine corrosion, subcommittees are studying specific problems of corrosion in equipment, such as condensers, stills, cracking units, tanks, valves, tankers, and barges.

The committee on pipe line and production corrosion has concentrated on protective coatings for underground pipe lines. On the recommendation of the committee, the Institute employs a research associate at the Bureau of Standards, who devotes himself to a study of underground pipe lines and methods of protection against existing corrosion. His work has been of considerable assistance to all companies operating pipe lines where corrosive conditions exist. Through the joint efforts of the research associate and the committee on pipe line and production corrosion, a code covering the application of hot bituminous coatings has been prepared and published.

Automotive Transportation

In 1927, the board of directors authorized the appointment of a General Committee on Automotive Transportation to consider co-operative problems relating to the construction, operation, and maintenance of oil company motor and truck equipment. This committee has co-operated with the Committee on Flammable Liquids of the National Fire Association in the preparation of a good practice statement for the construction and operation of gasoline tank trucks. It is now engaged, through its three regional groups, in a study of various problems of mutual interest, including operating practices, maintenance problems, and standards of construction.

Fundamental Research

A five-year program of fundamental research, made possible by separate contributions of $50,000 per year for five years by John D. Rockefeller, Sr., and by the Universal Oil Products Co., is now in its fourth year. Twenty-eight projects in the physics, chemistry, and geology of petroleum are now being investigated at various university and other laboratories, in this country and abroad, through fellowships established from these funds.

At the inception of this program, the assistance of the National Research Council was requested; and a Central Petroleum Committee was organized, with three representatives each from the fields of geology, physics, and chemistry, to enable the council effectively to comply with this request. This Central Petroleum Committee, with the co-operation of the Institute's Advisory Committee on Fundamental Research, recommends projects and personnel for each year's program.

Authorization rests with the three trustees—Messrs. Teagle, Kingsbury, and Boyd—appointed by Mr. Rockefeller in the case of the projects supported by the Rockefeller fund, and with the special committee on research appointed by the board of directors of the Institute in the case of the projects supported by the Universal Oil Products Co. fund.

The results that have been obtained from the various projects have been published from time to time in various technical and scientific publications. Up to the present time, 71 research papers have been published or have been approved for publication.

The benefit to the petroleum industry of this fundamental research cannot be foretold or calculated. The industrial development of the world at large has been based upon a foundation of facts and principles discovered by research in pure science, and the object of our fundamental research program is to establish such a foundation for the petroleum industry. New developments in petroleum production and refinery technology will require an ever broadening foundation of scientific knowledge, and undoubtedly our research program will play an important part in its construction. The industry generally should not fail to co-operate wherever possible with this program of research; and thought should be given, and plans developed, for refinancing and carrying on the work when the funds so generously provided by Mr. Rockefeller and by the Universal Oil Products Co. are exhausted.

Standardization of Material

The work of standardizing and simplifying oil field equipment, in which the Institute has been engaged with such signal success, has made marked progress during the past year.

A questionnaire was circulated this year to ascertain the extent to which A.P.I. standards are being used and what results have been obtained. The replies were gratifying, in that they indicated hearty co-operation on the part of major oil companies. The consensus of opinion is that the A.P.I. standards have accomplished a great deal in establishing higher and more uniform grades of material. Distinct progress is being made toward more complete interchangeability on the principal threaded connections, such as taper joints for rotary and cable tool drilling, and on tubular goods. Many operators report on tubular goods, particularly, that trouble with threaded connections — which formerly was the major cause for complaint—has practically disappeared.

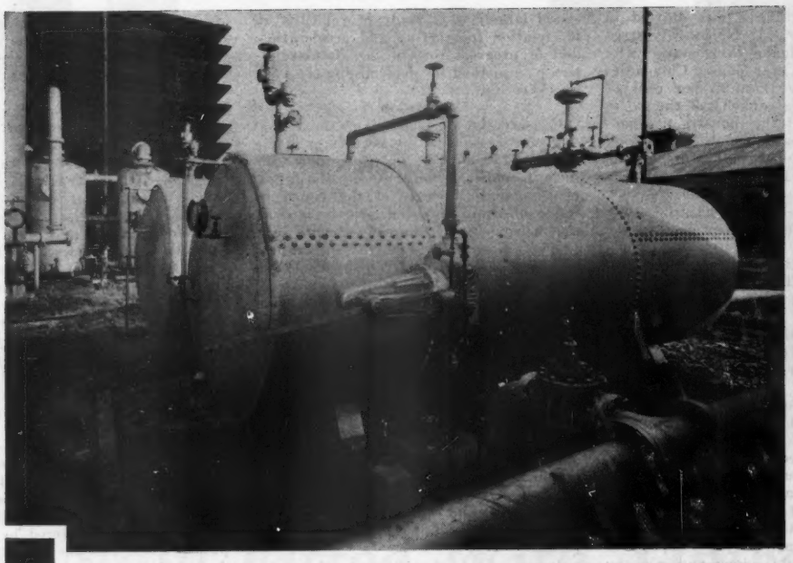
These replies, however, developed that the executive and management men of the industry do not take as active an interest as they might in directing the introduction and use of A.P.I. standards and codes. I strongly urge all the officers and departmental managers of every company to support this constructive work and direct the use of A.P.I. standardized material. Many companies have already issued mandatory orders requiring the use of these standards and codes. The executive, with the authority at his command, can easily reap the benefit for his company from these standards and codes by requiring their use on his properties.

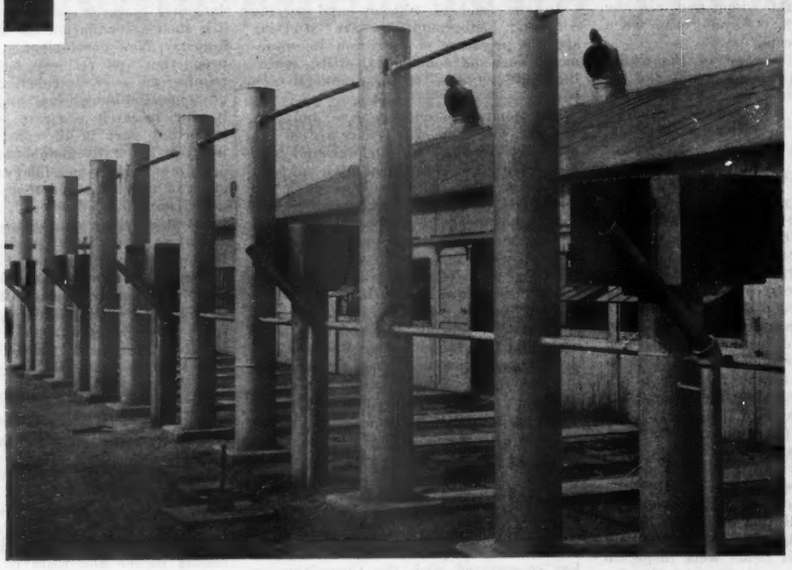
The Division of Development and Pro-

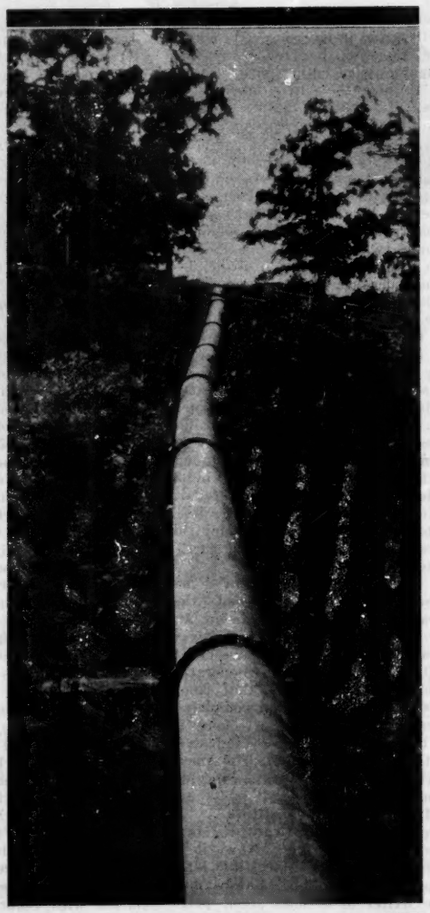
(Continued on Page 190)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill. December 3, 1929.

HANLON-W







Upper left: One of numerous Fisher Liquid Level Controller installations in the oil and gas industry.

Lower left: Reed Three Unit Type SCF Air Filters furnishing Clean air to compressors at Mid-Continent Gasoline Plant.

Above: "Victaulic Couplings for every joint in every line" has become a buy-word with major operating companies.

WATCH FOR ANNOUNCEMENT OF A NEW DEPARTURE IN SEPARATOR TYPES

HANLON-W

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General Offices

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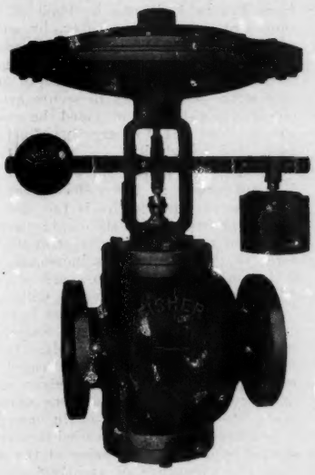

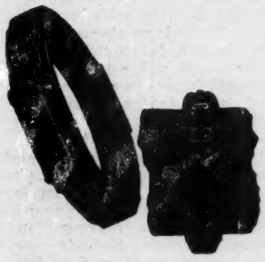

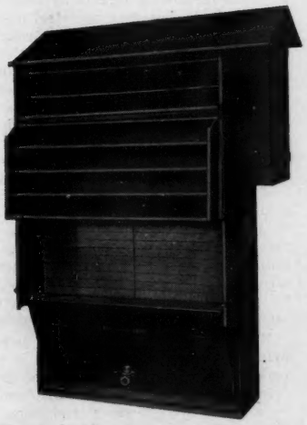

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Metallurgy of Drilling Equipment

Use of Alloy Steels and Heat Treatment Discussed. Rigid Control of Process Necessary for Uniform Properties

By H. W. Fletcher
Hughes Tool Co.*

Four quantities are customarily used in describing the physical properties of a metal. They are ultimate strength, elastic strength, ductility, and reduction of area. Each of these quantities is evaluated by testing to destruction a test piece of the material in question, or specified diameter and under specified conditions of loading. A change in the dimensions of the test piece or in the conditions of loading will alter the numerical values secured from the test, but at least the figures are comparable between various standard test specimens. The use of these quantities as a measure of the relative suitability of various materials for a given practical application is justified, provided due consideration be given to the modifying influence of product, shape and manner of loading in actual service.

The ultimate and elastic strengths are a measure of the ability of the metal to carry load, while the elongation and reduction of area indicate the extent to which it can deform under load without fracture. This latter property is quite as important as the former, since design considerations will but rarely permit the complete avoidance of undesirable stress concentration arising from the notch effect of threads, shoulders, and keyways. If the metal is plastic, it will yield at those points where stress is excessive, and so redistribute the load over a larger area of metal. If it is not plastic, a small crack may develop, which in turn will vastly increase the local stress; the crack will extend; the process will repeat, and complete failure will result.

Heat Treatment and Alloys

Fortunately heat treatment furnishes a means for adjusting the relative values of strength and plasticity, and the introduction of certain alloys affords still further control of these properties.

With the exception of the carburizing and nitriding processes, heat treatment properly carried out does not alter the chemical composition of steel. It does, however, affect the physical distribution of the elements in the steel. By simply heating to the proper temperature and cooling rapidly, the strength of the material can be raised to a surprising degree, the effect being much more pronounced with the so-called alloy steels than is the case with plain carbon steels. Unfortunately the plastic properties are simultaneously reduced; and if care is not used, stress concentration may entirely offset the gain in strength. Furthermore, the outside of the steel must be cooled first, and the outer layers consequently shrink before the inner portions cool, setting up bursting stresses due simply to volume changes. However, if the process is skillfully handled, actual cracking of the metal during this sudden cooling can be avoided, and the metal can then be reheated to a lower temperature, thus relieving these stresses. Therefore, heat treatment can be used to adjust the relation of strength to plasticity in accordance with estimated requirements of the job.

Tool Joints

The tool joint can be considered as an example for the application of these ideas to rotary equipment. The most common causes of failure in early tool joints were galling, stripping of threads, wear from abrasion, tension failure of the pin, and splitting of the pipe ends. It can be concluded that if a harder and tougher material is used, galling and abrasion will be reduced; while failures in the pins and pipe ends can be controlled by using a stronger material. Immediately, however, it will be perceived that the fundamental properties do not describe hardness and toughness directly, and further consideration shows that a satisfactory general definition is most difficult to form. However, it is safe to conclude from analogy that if the strength be raised, hardness and perhaps toughness will be increased somewhat, and then remains a decision as to how much plasticity can be sacrificed safely. Here a question of judgment is involved, which can only be solved on the basis of previous experience and justified by service performance. Suppose, however, that a heat treated alloy steel, with an appreciably higher strength and a plasticity little—if any—below that of the material formerly used, can be found. It is reasonably certain that improvement will result if uniformity of practice can be satisfactorily maintained, for it should be kept in mind that careless handling of sensitive steel may easily result in more failures than would follow the use of a lower grade stock, unheat-treated.

Evidently, it is necessary to control the temperatures of heating and quenching, the rate of heating and—most important of all—to have some method of inspection that will cull out defective pieces before they leave the plant. In this case, inspection by Brinell impression is the most satisfactory test now available.

Brinell values and strength are rather closely correlated for a given steel, so an upper and lower Brinell limit can be set and manufacture can be started—preferably on a rather small scale at first. Now field performance must be watched closely, and the cause of failures must be analyzed; the upper Brinell limit can then be reduced if the material seems to be too hard (not sufficiently plastic), and the lower Brinell limit can be raised if the material seems too soft as evidenced by excessive galling and wear. As data accumulate year after year, field failures will be markedly reduced and about equally divided as to cause (hardness or softness), indicating that the best possible range of treatment for that particular product and material has been developed.

General Method

This broadly is the general method of attack on all problems of this nature: first a tabulation of types of failure; then a consideration of the probable influence of a change in the fundamental physical properties; and, finally, controlled manufacture accommodated to field experience.

Many alloy combinations are on the market, and the problem of selecting the best for a given purpose is by no means a simple one. However, the steel manufacturer is often able, through past experience with related service problems, to recommend two or three steels that are fairly certain to give satisfaction, which narrows down the field. As a measure of the relation between strength and plasticity, Figure 1 shows ultimate tensile strength plotted against per cent reduction of area for various heat treatments. Three steels are illustrated: a simple carbon steel containing 0.45 per cent carbon; a chrome nickel containing 1.25 per cent nickel and 0.6 per cent chromium; and another chrome nickel containing 1.75 per cent nickel and 1 per cent chromium, both the chrome nickel steels bearing 0.4 per cent carbon.

Basis of Selection

If it be decided that a reduction of area of 50 per cent will represent sufficient plasticity for the purpose at hand, and if an ultimate strength of 100,000 pounds per square inch is great enough, then inspection of the graph shows that all three of the steels meet these requirements; and the selection must then be based on relative cost, commercial availability, ease of machining, and the question of how much margin the assumed requirements provide over the actual service conditions to be met. It must be remembered that corrosion, fatigue, abrasive wear, roughnecks with sledge hammers, and other detrimental agencies will be encountered in the field. The writer recalls one instance when a new string of chrome nickel tool joints on a foreign wildcat was cyanided in an open forge fire, while the crew waited for cement to set. Had these tools been simple carbon, they might not have been greatly harmed; but, as it

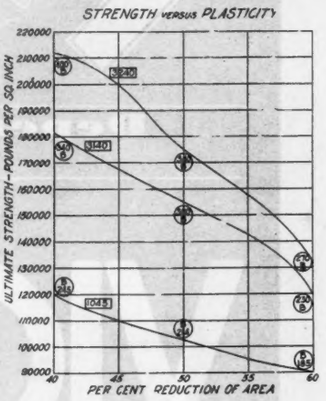


Figure 1.

was, they were ruined. This is, of course, an extreme case, and would have little weight in determining the selection of material; but other examples may be cited that do apply. For instance, early alloy joints were made quite hard to reduce abrasive wear, while at the same time plasticity was not reduced below that of the carbon joints then in use. A most satisfactory reduction in wear resulted, but tong difficulties were so excessive that the operators undoubtedly suffered a net loss, even though their joints lasted longer.

Suppose now that experience with the straight carbon steel 1,045 has been unsatisfactory, i.e., if the heat treatment produces sufficient plasticity, the strength is too low and vice versa: the question arises as to whether 3,140 or 3,240 shall be used. About 10 per cent greater strength can be obtained by using 3,240 instead of 3,140. On the other hand, the former is more expensive, more subject to internal defects in course of manufacture, more delicate to heat treat, etc. It is entirely possible that failures might be more frequent using 3,240 than would be the case with 3,140. On the other hand, if service loads should increase to a point where on the average the 3,140 is working very close to its limit, a 10 per cent increase in strength secured by changing to 3,240 might almost eliminate failures. It is a hard question, and must inevitably be solved in relation to the special condition of any single case.

Heat Treated Alloys

Much has been said about using heat treated alloys to increase strength, and the question might well be raised: "why not make the parts bigger?" Sometimes that can be done. A drawworks shaft, for instance, can be made 60 per cent stronger, and at the same time stiffer, if it is increased from 6-inch diameter to 7-inch diameter. It will be 36 per cent heavier, but then it is pretty heavy anyhow. On the other hand, as can be readily seen from Figure 1, it can be made 60 per cent stronger, but no stiffer, by substituting heat treated alloy steel; it will be no heavier, but it will cost at least twice as much. Obviously, an increase in diameter is the logical way to secure greater strength in this case, provided the greater weight does not too greatly affect the matter of portability.

On the other hand, rotary chain is subject to impact as the rollers meet and leave the sprocket teeth. If the size, and hence the weight, of the chain parts is increased to secure greater strength, the force of these impacts is increased; and it is entirely possible to reach a point where further increase in size will result in an increase in failures. Here is an excellent opportunity to improve matters by using heat treated alloy steels. As the strength of the material is increased, the weight required to carry a given static load is reduced and, hence, the dynamic loads are less. Rotary chain manufacturers have universally availed themselves of this opportunity, securing at the same time the advantage of greatly increased resistance to wear.

A third class of product is restricted in dimension by service requirements, e.g., bits and tool joints obviously must be smaller than the holes in which they are used. There is no alternative when greater strength is required. Heat treated alloy steels will provide the additional strength in the same space, the only question being what alloy and how to heat treat it.

Heat Treatment

Heat treatment consists in slowly raising the temperature of the piece until, at the so-called critical temperature, the grain structure—normally pearlitic at low temperatures—is converted to a form called austenite. Entirely new crystals are formed, small at first but growing larger as the temperature continues to increase. If the steel is cooled slowly, the process will reverse, and the austenite will be converted back into pearlite, the physical properties remaining practically unaltered. If, however, the steel is cooled suddenly by plunging it into relatively cold oil or water, this transformation can be suppressed to a degree depending on the chemical position of the specimen. In this condition, the material exhibits maximum strength and hardness, and minimum plasticity; and is generally unsuitable for service. The microstructure resulting will depend on the speed of cooling and on the rate at which the transformation takes plac, i.e., it may not be possible to cool the specimen quickly enough to prevent a certain degree of transformation; and, hence, the quenched structure, instead of being austenite, may be one of the intermediate structures: martensite, troostite, or even sorbite.

Sprockets and sheaves of 14 per cent manganese steel are martensitic in structure at cast, since these high percentages of manganese slow up the transformation to a very high degree; and even very slow cooling in sand molds is in effect a quench. Martensite is very hard, but also very brittle, and hence unsuited for this type of product; so the castings are reheated to a point where the martensite changes to austenite, and are then quenched to prevent the austenite from changing back. The austenite is not so hard, but is much tougher and more plastic than the martensite, exhibiting great shock resistance and resistance to abrasion. Nickel and chromium added in large amounts will also suppress the transformation to a point where an austenitic structure is readily produced, and are useful because of the exceptional resistance

(Continued on Page 189)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill. December 5, 1929.

Magnetic Compasses in Well Survey

Discrepancies in Use Accounted for by Failure to Recognize Nature of Instrument and Possible Influence of Surroundings

By Frank Rieber*

Attempts have been made for some time to use the magnetic compass as a means for making surveys in bore holes. Experiments with this instrument under these conditions have not been uniformly satisfactory, and have in fact been subject to so many discrepancies as to give rise to the opinion in some quarters that it is not feasible to use a compass at all in a bore hole.

It is believed that these discrepancies in actual use can be completely accounted for by the failure on the part of the users to recognize the nature of the instrument with which they were dealing, and the possible influence of its surroundings upon the accuracy of the results. The following notes have been compiled in an attempt to discuss this point.

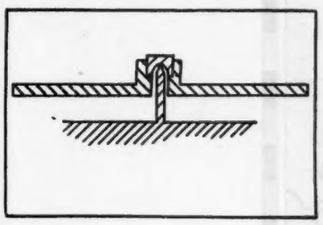


Figure 1.

The common magnetic compass as here illustrated consists of a bar of hard steel, in the center of which is mounted an inverted cup bearing. This bearing hangs over a stationary pivot, in such manner that the center of gravity of the needle and bearing, considered as a whole, lies below the center of support constituted by the tip of the pivot. Hence the assembly, before being magnetized, should hang as shown, in a horizontal position.

Figure 2.

If we now magnetize such a needle as was shown in Figure 1 above, and again hang it upon the pivot, we will find, if we are in a northern latitude, that the northern end of the needle will dip sharply downward as shown, and that it will no longer balance. If we had been in a southern latitude, the southern end of the needle would be the one which dipped. Only if we are reasonably near the equator will we find that the balance of the needle is not greatly disturbed after it is magnetized.

The reason for this dipping will be found when we consider the direction of the magnetic field of the earth, considered as a whole. Figure 3 illustrates this field, which is commonly supposed to be due to magnetic currents within the earth.

Circulating Currents

Circulating currents traveling around the axis of the earth, or flowing in the upper atmosphere, and influenced by the rotation of the earth may have something to do with this phenomenon also. From the diagram, in general, it will be noted that the direction of the lines of force is nowhere parallel to the surface of the earth, except at the equator.

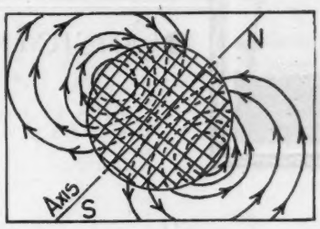


Figure 3.

For example, at San Francisco, the direction of the total earth's field dips at an angle of approximately 60° from the horizontal. This field may be conveniently divided into a vertical and horizontal component, and thereafter treated as if two independent fields existed at the same time. The horizontal component of the earth's field is the one which may be used to direct the compass needle and

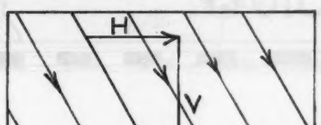


Figure 4.

cause it to point towards the magnetic north. The vertical component of this field can be considered as a supplementary field, applied vertically, which causes the compass needle to dip as shown in Figure 2 after it has been magnetized.

To compensate for the tendency of the compass to dip, and to permit it to rotate in a truly horizontal plane it is customary to provide a counterpoise weight. This weight is slid out along the needle until the downward gravitational force due to the weight on one pole equals the magnetic force which formerly caused the other pole to dip downward. Thus in

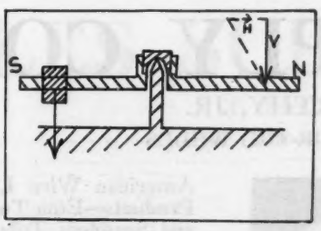


Figure 5.

northern latitude the weight must be placed on the south pointing pole in the compass to make it balance. While in southern latitudes the weight must be placed on the pole which points north.

Such a balance compass needle will remain balanced accurately for only one value of the vertical field component. If for any reason the vertical field changes, the compass will cease to remain exactly horizontal. For example, if we take a previously balanced compass, adjusted to remain horizontal in the latitude in which we are situated, and if we hold a control magnet exactly centered over the axis of rotation, the presence of this magnet will not in any way influence the direction in which the compass will point around its calibrated circle. The magnet will, however, change the total vertical component, and cause the compass to dip, as shown. If the magnet is placed too close to the compass, it will dip sufficiently to interfere with its free rotation about the pivot. If we wish, however, we could mount this control magnet rigidly on the base that supports the compass, in such a manner that it always remains over the axis, and we could then correct the compass for dip by

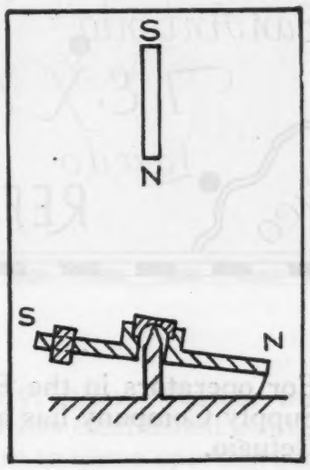


Figure 6.

sliding the control weight to a new position. The complete device would then serve as accurately as before, provided it was always maintained in such a position that the control magnet was exactly vertical over the axis of the suspension of the compass.

A different type of compass may be constructed, which is superior to that just illustrated under certain conditions, by mounting the rotating system on two bearings instead of a single one. Such a compass is shown in Figure 7, and consists of a slender vertical shaft whose lower pointed end rests in a cup bearing. The upper end of this shaft is lightly centered in a steadying bearing. It is desirable to have the total center of gravity as low as possible, in order that the tendency of the shaft to press against the steady bearing, for inclined position, may be reduced as much as possible. A compass of this type may be used without placing any weight upon the needle, if the axis of the compass is always to remain vertical. If we wish to use it with an inclined axis at times, it will be necessary to counterweight the appropriate pole of the compass in such manner as to compensate for the vertical component of the earth's field at the point at which we are situated on the surface. With such a counterweight properly adjusted, the compass will point north under all conditions of inclination of the axis, within the limits of operation to be discussed later. The gravitational moment due to the presence of the weight will accurately balance the magnetic moment due to the vertical component of the field, with respect to rotation about the axis.

Preferable Form of Compass for Use in Bore Holes

Having briefly discussed the characteristics of the single and double bearing compass, we can now consider the preferable form to select for use in surveying oil wells. In considering this question,

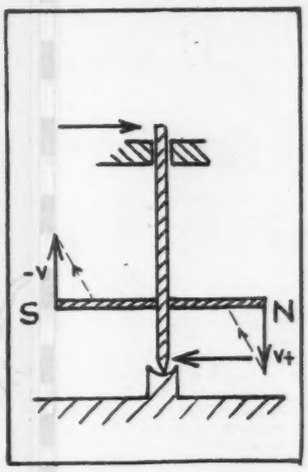


Figure 7.

it must be borne in mind that the general problem of surveying wells may be divided into two parts as follows:

1. Surveying of holes previously drilled, whose inclination may reach a large deviation from the vertical.
2. Surveying of holes during drilling, with the object of measuring the deviation from the vertical, and correcting it if it exceeds a given amount.

The requirements for these two types of service are somewhat different, and

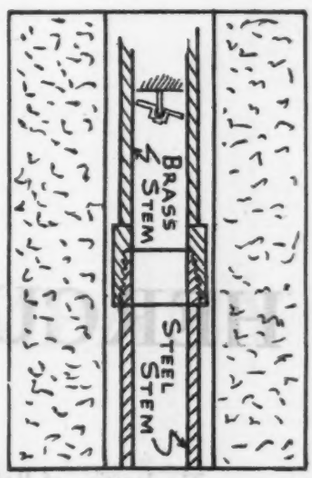


Figure 8.

can be arrived at after a brief consideration of the effects of the drill stem at various inclinations.

Figure 8 shows a compass device, used in an open hole, and mounted in a brass capsule on the end of the drill stem. The lower end of such a drill stem, for reasons which will be discussed later, becomes rather strongly magnetic, and hence acts in the same manner as the control magnet discussed in Figure 6. If

*Mr. Rieber is a nationally known geophysicist who has made noteworthy contributions to the development of the torsional balance and has developed the geophysical system known as the elastic wave. In recent months he has been making research in the action of compasses as applied to well surveying instruments and his company is perfecting a new type of well surveying apparatus.

Announcing Two

at Refugio, Texas

For operators in the Refugio field the Hercules Supply Company has a new store in the town of Refugio.

Refugio is in the Southeastern part of Texas, almost on a direct line between Houston and Laredo. It is near the coast, at Aransas Pass, 130 miles Southeast of San Antonio.

Operators in this vicinity are invited to use the full facilities of this store, the only one in the entire territory.

HERCULES SUPPLY COMPANY

J. T. McCARTHY, JR.
EVERYTHING FOR OIL WELLS

The location of Refugio, much more isolated from the standpoint of supplies than appears on the map, makes this store of greater assistance to the industry than a far distant buyer would appreciate. Your full requirements can be cared for. Service is given as the oil man wants it.

American Wire Lines — Lucey Rotary Products—Etna Tubular Products—Standard Seamless Tubular Goods—Guiberson Tubing Catchers and Swabs—Hughes Tool Co. Products—Baker Oil Tools Co. Products — Bettis Protectors — Walworth and Crane Valves — Quaker City Belting—Worthington Pumps — Hundreds of other items.

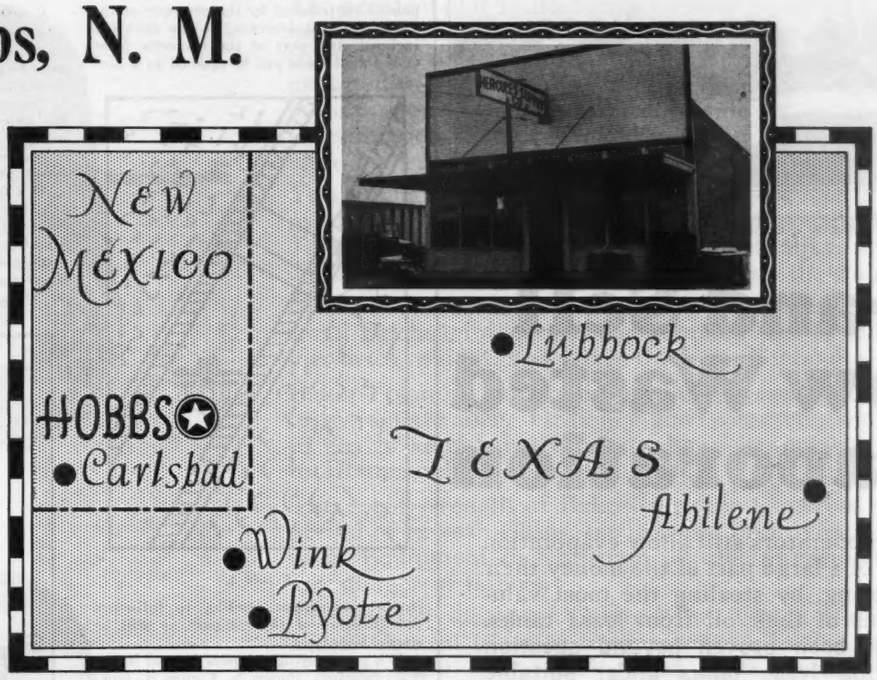
Stores: Pampa, Texas, Wink (Pyote) Refugio, Texas

General Offices: Fort Worth

Isom (Borger), Vernon (Wilbarger) Hobbs, N. M.

New Hercules Stores

at Hobbs, N. M.



At Hobbs, in Lea County, New Mexico, the Hercules Supply Company has established a fully stocked oil field supply store to serve operators in this inaccessible territory.

Hobbs is in the extreme Southeastern part of New Mexico about seventy miles north of Wink and Pyote and about seventy miles east of Carlsbad.

Operators in this territory will find the Hercules Store a decided convenience in the quick delivery of tools and equipment.

HERCULES SUPPLY COMPANY

J. T. McCARTHY, JR.

EVERYTHING FOR OIL WELLS

Unfortunately, the map does not indicate the real inaccessibility of the field and the unusually poor condition of roads leading into the territory. This makes the factor of time of great importance in ordering from the Hercules store as from one to three days can be saved in deliveries.

American Wire Lines — Lucey Rotary Products—Etna Tubular Products—Standard Seamless Tubular Goods—Guiberson Tubing Catchers and Swabs — Hughes Tool Co. Products — Bettis Protectors—Walworth and Crane Valves—Quaker City Belting—Worthington Pumps—Hundreds of other items.

Stores: Pampa, Texas, Wink (Pyote) Refugio, Texas

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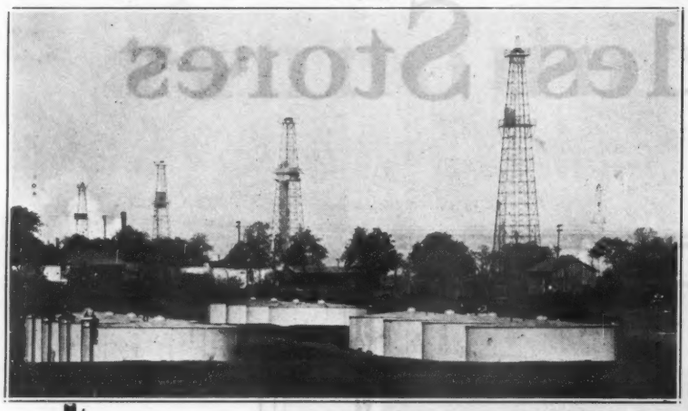

Twelve 500-Bbl. Maloneys on I.T.I.O. Fortson Lease, Oklahoma City, Erected by distributer Maloney Sales Corporation.

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the single bearing compass as shown is used under such conditions, unless it is placed at a considerable distance from the end of the drill stem, and separated therefrom by nonmagnetic casing, the compass will dip to an amount which will interfere with its operation. If this tendency to dip is neutralized by adding to the counterweight on the compass needle, it may be caused to remain horizontal as long as the drill stem is vertical. If the device as shown is used in an inclined hole, however, the vertical component contributed by the presence of the drill stem will decrease, as the device is inclined, and part of the magnetic force of the drill stem will be applied as a horizontal component tending to influence the direction of the compass as will be shown later.

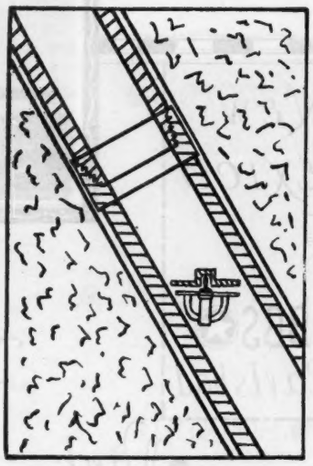


Figure 9.

If a two bearing compass is used under the conditions shown in Figure 8, however, it may be placed very close to the end of the drill stem, without any influence other than an increase in the friction on the bearing, due to the additional magnetic moment produced by the presence of the drill stem.

Since a compass of the single bearing type will operate only if the pivot on which it is suspended is approximately vertical, the use of an instrument of this type in inclined holes is only possible if the entire compass is mounted in such a manner that its plane of rotation remains approximately horizontal. Gimbals of the form used for marine compasses can be applied as shown in Figure 9, so that the compass needle will remain horizontal and the pivot will remain vertical even in an inclined hole.

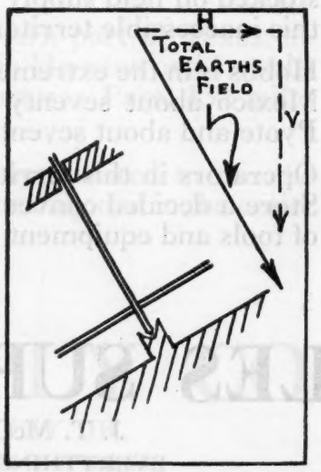


Figure 10.

Another effect comes in here, however, in that the end of the drill stem is magnetic, and, for inclined positions, is no longer directly above the axis of rotation of the compass. And if the drill stem is not exactly over the axis of the compass, it will influence to a considerable degree the direction in which the compass points, by changing the horizontal components acting on the needle. This tendency to influence the compass direction can only be offset by providing a relatively great length of nonmagnetic supporting material between the end of the drill stem and the compass itself, which entails a considerable expense.

Two Bearing Compass

A two bearing compass, properly mounted with its axis parallel to and coincident with the axis of the drill stem, can not be influenced in the manner shown in Figure 9, but will always point to the proper magnetic direction, unless the axis of the compass is inclined to bring it closely parallel to the direction of the earth's field. When this axis becomes identical in direction with the earth's field, no force whatever is exerted on the compass tending to make it point in any definite direction. This condition is shown in Figure 10, on the assumption that we are at San Francisco where the earth's field dips approximately 60° from the horizontal. If the compass

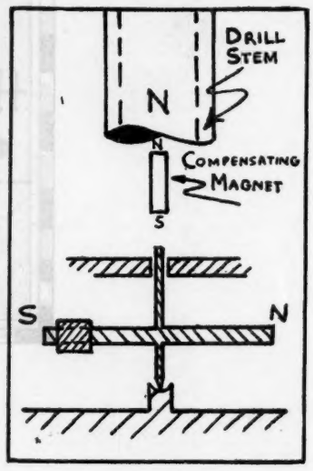


Figure 11.

axis is inclined in this direction, or 30° from the vertical, the compass may point in any direction which it pleases, and will not be influenced in any way by the presence of the earth's field.

As we approach this critical angle of 30° from the vertical, the influence of the earth's field on the direction in which the compass points becomes weaker and weaker. A good compass of this pattern can therefore not be relied on for direction if the inclination of its axis is greater than 20° from vertical, in a di-

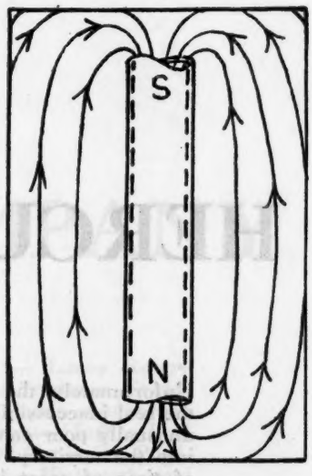
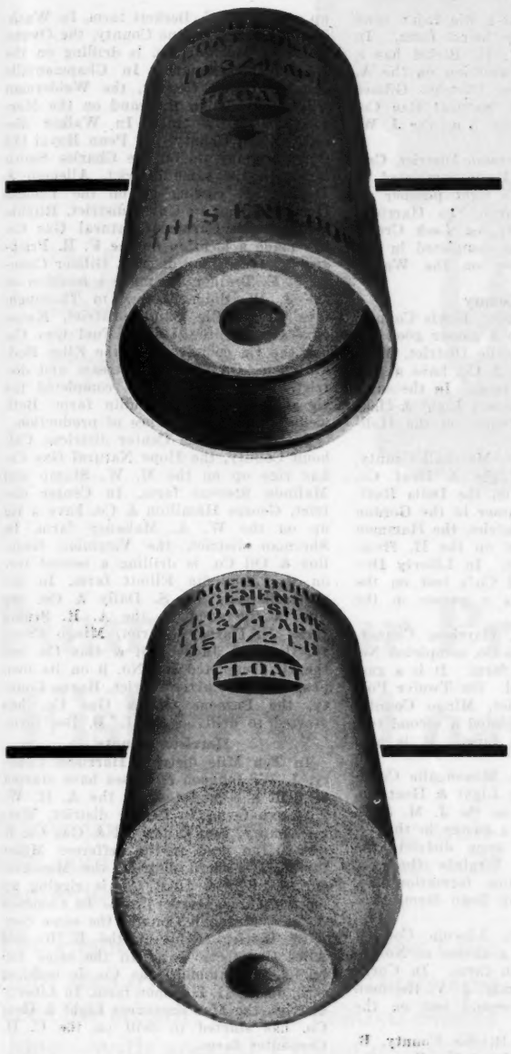


Figure 12.

(Continued on Page 190)

There Are Vital Safety Elements in Baker Cement Equipment That You Cannot See



The problem of manufacturing *Cement Floating, Guiding, and Cementing Equipment* that will stand up under even the most severe operating conditions—that will withstand unusual punishment when it comes unexpectedly—is not so simple a matter as it may seem to one not intimately acquainted with the long process through which the Baker Organization has been forced to travel to bring its Cement Equipment up to its present stage of perfection.

You might compare Baker-Formula Concrete, as used in Baker Cement Equipment, with the concrete used to lay pavements, for instance. To the eye they would look pretty much alike, if the paving had been done by a very careful workman. But there the comparison would cease.

Baker-Formula Concrete is strictly a laboratory product. It is made in small batches, mixed and compounded just as carefully as a druggist measures, weighs, and mixes the ingredients of a prescription.

Baker-Formula Concrete has a compressive strength of 6002 pounds to the square inch. Ordinary good concrete, such as you would find in any product using concrete, has a compressive strength of only 2800 to 3700 pounds to the square inch.

The great strength of Baker-Formula Concrete is the result of a long period of experimenting, testing, and improving. It enables Baker Cement Equipment to withstand unusual punishment in the well without any danger of failure.

The specially-designed Celoron Ball Check Valve and Valve Seat in Baker Cement Floating Equipment is also the result of many months of experimenting and testing, and, in its present form, will withstand pressure up to 5500 pounds to the square inch.

These are the Hidden Values in Baker Cement Equipment. They have the Baker Guarantee behind them, and that, in the oil industry, has a real meaning.

Buy Baker Cement Equipment. Use It. Prove It. Standardize On It. Refuse any substitutes. It will increase your safety factors and protect your investment.

Baker Cement Float Collar

The Baker Cement Float Collar, as here illustrated, is a Baker-Formula Concrete Plug cast and anchored in rounded grooves in a special seamless steel coupling, 20 inches in length. The concrete plug contains the Celoron Ball Check Valve and Valve Seat.

Both the concrete and the Celoron will disintegrate readily under the drill and circulate away freely, leaving a clean hole for any subsequent operations.

Baker-Burch Cement Float Shoe

The Baker-Burch Cement Float Shoe is a Plain Casing Shoe with a Baker-Formula Concrete Plug, cast and anchored in rounded grooves in the shoe. The plug contains the Celoron Ball Check Valve and Valve Seat. Both will drill out clean and fast.

This Float Collar and Float Shoe were used in Kettleman Hills to land 330,000 pounds of 11¾-60-pound casing, and they did the job safely and without a hitch. Use them both on your string for added safety.

WRITE FOR LITERATURE: — For the sake of efficiency, economy, and safety, you should have an accurate and complete knowledge of Baker Cement Floating, Guiding, and Cementing Equipment. Complete descriptive literature will be sent on request. WHY NOT ASK FOR IT NOW?

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The BAKER LINE of Oil Well Specialties COMBINES Superior Performance with Economy.

Stocks carried by Dealers in all active Mid-Continent fields.

Perry County Leads Southeast Ohio

Furnished Most of the Production During November. Harrison Township Has Two Better Than Average Wells

By D. S. Wakenight
Staff Correspondent, Eastern Fields

PITTSBURGH, Pa., Dec. 2.—During the past month, Perry County, in southeast Ohio, furnished the most new production. In the northeast quarter of Section 4, Harrison Township, the W. J. R. Production Co. completed and shot in the Clinton sand a test on the David A. Sagle farm. It produced 75 bbls. the first 24 hours. In the same locality, the same company completed and shot in the same formation a test on the Charles Brown farm. It produced 180 bbls. the first 24 hours. In the southwest quarter of Seciton 4, the Leonard Oil & Gas Co.'s test on the John Dilts farm produced 30 bbls. the first 24 hours.

In Section 7, Hanover Township, Licking County, the Pure Oil Co. got a 90-bbl. producer when it completed and shot a second test on the H. C. Priest farm. In the northeast quarter of Section 24, Green Township, Hocking County, the Griffin Producing Co. completed and shot in the Clinton sand a test on the Marlow Oil Co.'s lease. It produced 65 bbls. the first 24 hours.

SOUTHEAST OHIO

Hocking County

In section 29, Ward Township, the Preston Oil Co. completed in the Clinton formation No. 1,353 on the Sunday Creek Coal Co.'s property. Nothing but a little gas was developed at this location.

In Section 32, Newton Township, Muskingum County, Sand Oil & Gas Co. has a duster in the Clinton sand on the G. N. Wilson farm. In the southwest quarter of Section 4, Harrison Township, Perry County, Crowley, Carr & Co. have a 2-bbl. pumper in the same formation on the George Wetsell farm.

In the southeast quarter of Section 3, Pike Township, Coshocton County, the Hope Construction & Refining Co. has a gasser in the Clinton sand on the Perry Ashcraft farm. Inside the corporate limits of Alliance, Stark County, the Hill Top Oil & Gas Co. of Alliance has completed a second test on the Consolidated Realty Co. lots. It is a 4-bbl. pumper in the Berea grit. Located inside of the same corporate limits, the same company completed in the Berea grit a 5-bbl. pumper on the Albert H. Oyer farm.

Noble County

In Section 18, Seneca Township, Noble County, Berry Rich and others have completed in the Berea grit No. 11 on the Silas McLaughlin farm. It is a very light pumper. In the northeast quarter of Section 31, Enoch Township, same county, Levi Hall and others have completed a second test on the Otto Dillehay farm. It is a duster in the Macksburg 500-foot sand.

In Hopewell Township, Muskingum County, the Hopewell Fuel & Gas Co. has a 3-bbl pumper in the Clinton sand on the T. C. Sidle farm. In Section 10, Wheeling Township, Guernsey County, the Ohio Fuel Gas Co. has a duster in the Niagara lime on the D. Cramblett farm. In Section 11, same township, the East Ohio Producing & Refining Co. has a fair producer in the same formation at No. 3 on the E. C. Quinlan farm.

In Washington Township, Tuscarawas County, the Ohio Falls Oil, Gas & Supply Co. is drilling tests on the O. A. Quinlan and J. M. McFadden farms. Koontz & Lynch have a rig up on the Lamming farm.

In the northeast quarter of Section 5, Hopewell Township, Muskingum County, the Hopewell Fuel & Gas Co. has completed in the Clinton sand a light pumper on the T. C. Sidel farm.

Monroe County

In Section 30, Bethel Township, Monroe County, the Hope Construction & Refining Co. completed No. 12 on the Knowlton heirs' farm. It is a 2-bbl. pumper. In the same township, the Indian Run Oil & Gas Co. completed No. 3 on the Annie Holiday heirs' farm. It is a gasser. In Washington Township, the Straight Fork Oil Co.'s test on the Oliver Cline farm is a gasser. In Wayne Township, the Brister Oil & Gas Co. has a gasser on the M. Christy farm. In Malaga Township, Section 6, W. C. McBride, Inc., has a very light pumper on the D. L. Hagan farm. In Section 6, same township, C. W. Paine & Co. have a duster at No. 6 on the Jacob Reumenschader farm. The same parties have a duster at No. 39 on the M. J. Stewart farm.

In the northwest quarter of Section 21, Reading Township, the Planet Oil Co. completed a very light pumper in the Clinton sand on the Vincent Maloy farm.

Washington and Morgan Counties

On Baker Run, Section 28, Lawrence Township, Washington County, Coon, Cline & Co.'s second test on the S. E. Dye farm is a light pumper in the first Cow Run sand. In the northwest quarter of Section 27, York Township, Morgan County, the Leonard Oil & Gas Co. completed in the Clinton sand a test on the A. L. Giles farm. It is a duster.

In the northeast quarter of Section 16, Washington Township, Muskingum County, the Atha Oil Co. completed in the Clinton sand a test on the Charles White farm. It is a gasser good for 2,000,000 feet a day. In Sutton Township, Meigs County, B. M. Tyree completed in the Berea grit a very light pumper on the Stanley Holter farm.

In Section 25, Hardy District, Holmes County, the Preston Oil Co. completed and shot in the Clinton sand a second test on the Philip Collier farm. It produced 25 bbls. the first 24 hours. In Section 23, Monroe Township, Perry County, O'Conner & Co. completed in the Berea grit No. 19 on the Sunday Creek property, good for 5 bbls. a day.

Licking County

In Section 11, Mary Ann Township, Licking County, George H. Long completed in the Berea grit No. 8 on the C. D. Wiggins farm, good for 8 bbls. In Section 9, Perry Township, the Hope Construction & Refining Co. has a 10-bbl. pumper in the same formation at No. 4 on the Sarah M. Rector farm.

In Lawrence Township, Washington County, Coon, Cline & Co. have a 2-bbl. pumper in the first Cow Run sand on the S. E. Dye farm. In York Township, Athens County, Campbell & Berlin have a duster in the Clinton sand at a second test on the Nelsonville Coal & Clay Co.'s tract.

WEST VIRGINIA

In Henry District, Clay County, the Virginian Gasoline & Oil Co. completed in the Big Injun sand No. 7 on the Brown, Swan, Goshorn & Odell tract, showing for a 12-bbl. pumper. In Church District, Wetzel County, the Manufacturerers Light & Heat Co. completed a second test on the Isaac Byard farm. It is a gasser. In the same district, the Delmar Oil Co.'s second test on the Palmer heirs' farm is a 15-bbl. pumper in the Gordon sand.

In Lee District ,the Hope Natural Gas Co. has completed a gasser in the Big Injun sand on the K. H. Hunt farm. In the same district, F. D. McIntosh's test on the S. A. Hays farm is a gasser in the same formation. In Center District, L. H. Bickel has a Big Injun sand gasser on the Stump heirs' farm. In Sherman District, W. H. Bickel has a gasser in the same formation on the A. Shock farm. In Troy District, Gilmer County, the Carnegie Natural Gas Co. has a fair gasser at No. 3 on the J. W. Rymar farm.

On Seekes Run, Sherman District, Calhoun County, W. S. Daily completed in the Big Injun sand a light pumper on the A. R. Stump farm. In Harrison District, Wood County, on Leek Creek, the Heck Oil Co. has completed in the Gordon sand a duster on the Walter Smith farm.

Lewis County

In Courthouse District, Lewis County, Bailey & Kraus have a gasser good for 500,000 feet. In Battelle District, Monongalia County, Eddy & Co. have a gasser on the J. L. Fox farm. In the same district, the Manufacturers Light & Heat Co. has a 15-bbl. pumper on the Hall-Jackson farm.

In Cameron District, Marshall County, the Manufacturers Light & Heat Co. completed No. 3,391 on the Della Ruffner farm. It is a gasser in the Gordon sand. In the same district, the Hammon Gas Co.'s second test on the H. Hammon farm is a duster. In Liberty District, the Denver Oil Co.'s test on the Mary Moore farm is a gasser in the Big Injun sand.

In Sardis District, Harrison County, the Hope Natural Gas Co. completed No. 1 on the Isaac Allen farm. It is a gasser in the fourth sand. On Twelve Pole Creek, Harvey District, Mingo County, G. H. Yates has completed a second test on the D. K. Vance farm. It is also a gasser.

In Battelle District, Monongalia County, the Manufacturers Light & Heat Co. completed No. 3,382 on the J. M. & E. B. Hall farm. It is a gasser in the 30-foot sand. In the same district, the Pittsburgh & West Virginia Gas Co. completed in the same formation No. 5,385 on the American Bean farm. It is a gasser.

In Carroll District, Lincoln County, L. R. Sweetland has a gasser at No. 40 on the E. F. Johnson farm. In Curry District, Putnam County, J. V. Reisman has a gasser at a second test on the William Glass farm.

In Grant District, Ritchie County, B. C. Deem & Co. completed No. 3 on the A. Hall farm. It is a gasser good for 1,250,000 feet. In the same district, George Lee and others completed a light gasser in the Squaw sand on the I. T. McFarlan farm.

In Mannington District, Marion County, C. S. Morris after a long fishing job on the Riley Arnett farm has abandoned the well with the tools in the hole. In Troy District, Gilmer County, the Carnegie Natural Gas Co.'s No. 3 on the J. W. Rymer farm is a gasser in the Big Injun sand. In Walton District, Boone County, the United Fuel Gas Co.'s No. 3,959 is a gasser in the Salt sand.

In Grant District, Jackson County, D. W. Law & Co. have a duster on the Leroy Kirchart farm.

Calhoun County

In Sherman District, Calhoun County, the United Fuel Gas Co. has a 5-bbl. pumper at No. 3,958 on the Armedia Elliott farm. In Lee District, M. F. Crowley has a gasser in the Big Injun sand at No. 3 on the Ida McCoy farm. In Sheridan District, G. L. Cabot's test on the L. F. Morrison farm is a gasser in the Big Injun sand.

Drilling and Starting Tests

In McComas district, Cabell County, the Hamilton Oil & Gas Co. is rigging up on the W. G. Beckett farm. In Washington district, Boone County, the Owens Bottle & Machine Co. is drilling on the E. B. Barker farm. In Chapmanville district, Logan County, the Weiderman Oil Co. is due in the sand on the Merrell Coal Co.'s tract. In Walker district, Wood County, the Penn Royal Oil Co. is rigging up on the Charles Smith farm. In the same district, Alleman & Horner are rigging up on the Thomas Heckard farm. In Union district, Ritchie County, the Carnegie Natural Gas Co. has made a location on the F. B. Prichard farm. In Troy district, Gilmer County, J. E. Trainer has made a location on the J. W. Snider farm. On Thoroughfare Creek, Big Sandy district, Kanawha County, the United Fuel Gas Co. has the rig completed on the Eliza Bodkin farm. On the same stream and district, the same company completed the rig on the C. W. Handlin farm. Both wells are far in advance of production.

In Sherman and Center districts, Calhoun County, the Hope Natural Gas Co. has rigs up on the M. W. Stump and Malinda Stevens farm. In Center district, George Hamilton & Co. have a rig up on the W. A. Mahaney farm. In Sherman district, the Virginian Gasoline & Oil Co. is drilling a second test on the Armindia Elliott farm. In the same district, W. S. Daily & Co. are due in the sand on the A. R. Stump farm. In Harvey district, Mingo County, the Red Jacket Oil & Gas Co. has the rig completed for No. 9 on its own property. In Curtis district, Roane County, the Parsons Oil & Gas Co. has started to drill on the L. B. Bee farm.

Harrison County

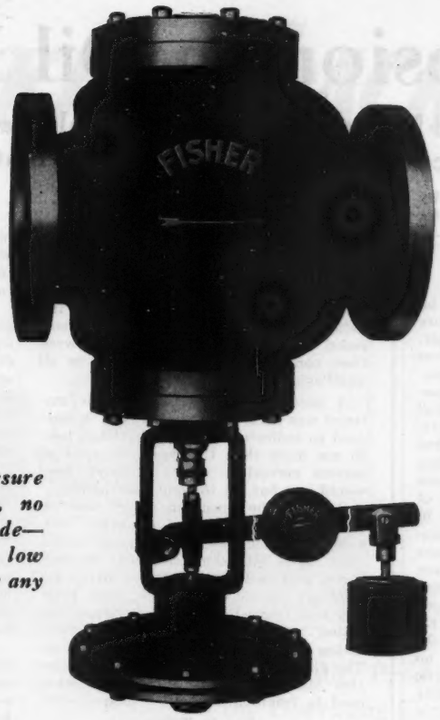
In Ten Mile district, Harrison County, J. W. Johnson & Moses have started to drill a second test on the A. H. W. Flanigan farm. In Center district, Wetzel County, the Valley Oil & Gas Co. is due in the sand on the Jefferson Miller farm. In Church district, the Manufacturers Light & Heat Co. is rigging up on the J. D. Horner farm. In Cameron district, Marshall County, the same company is rigging up on the B. R. and Alice Chambers farm. In the same district, the Hammon Gas Co. is building a rig on the H. Hammon farm. In Liberty district, the Manufacturers Light & Heat Co. has started to drill on the C. H. Carpenter farm.

In Center district, Calhoun County, Snodgrass Brothers have a rig completed on the Ida B. Jeffers farm, 3 miles in advance of production. On Twelve Pole Creek, Harvey district, Mingo County, E. J. Evans has a rig completed on the Lawrence Ferrell farm. In Lincoln district, Wayne County, the Wayne United Fuel Co. has a rig completed on the A. W. Wilson farm. In Ten Mile district, Harrison County, Dennison P. Varner and others have a rig completed on the J. Allen Varner heirs' farm. In Chapmanville district, Logan County, the Tompkins Gas Co. has made a location on the Hermon White farm. In Washington district, Lincoln County, the United Fuel Gas Co. is rigging up on the Mohler Lumber Co.'s tract. In Jefferson district, Lincoln County, Wolf & Rend have made a location on the Isaac S. Rand farm. In Sheridan district, the Hamilton Gas Co. has made a location on the Charles H. Hunter farm. In Clay district, Monongalia County, the Pedlar Run Oil Co. has a rig up on the Lewis Hess farm.

SOUTHWEST PENNSYLVANIA

In Cecil Township, Washington County, the Bishop Oil & Gas Co. completed in the Fifth sand a second test on the Tannehill farm, a 5-bbl. pumper. In

(Continued on Page 278)



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Combating Corrosion in Oil Refining

Ever Changing Conditions and Methods Call for Continual Research. Importance of Tests in Face of Highly Specialized Materials

By R. L. Duff
Standard Oil Development Co., New York*

ABSTRACT

The corrosion of metals in an oil refinery is a subject of importance and commands considerable study. The trend toward higher pressures and temperatures in refinery processes is demanding the use of materials possessing higher physical properties, as well as corrosion resistance. Alloys are being utilized to meet these complex problems, and their use is becoming more widespread. The importance of tests is, therefore, emphasized in face of the highly specialized materials being produced. Coatings also are of importance, and are being used successfully in many cases. Ever changing conditions and methods call for continual research. Each problem must be solved individually. There is no single application of material or method that can be universally adopted.

The corrosion of metals in oil refining equipment presents a subject of vital importance and cannot be considered as one problem, but rather as an ever changing group of problems wherein each particular item has to be investigated and suitable material found to meet the conditions encountered. The variations in conditions can be appreciated when it is realized that a material which will give satisfactory service in one location may prove worthless in another. Changes in equipment design, processing methods, and stocks handled continually present new problems.

In the search for the proper material for use in a particular location, many factors must be considered, such as temperature, pressure, velocity, strength required, expansion, ductility, conductivity, cost of material, obsolescense of equipment, ease of fabrication, resistance to shock or impact, as well as corrosion resistance.

The limiting creep stress is an important factor when considering metals for high temperature, high pressure service as well as corrosion resistance. Some metals possess high strength at normal or low temperatures, but are comparatively weak at temperatures between 1,100° F. and 1,800° F.

Ease of fabrication is a controlling feature in accepting a metal for service. A metal may possess wonderful corrosion resisting properties, but will not lend itself to shape of design; or perhaps welding may present a diffculty. Some metals can be welded in the horizontal position but not when vertical or overhead; others suffer changes in physical and chemical properties when gas welded.

Tests of Material

To determine whether a material meets the requirements for certain service, tests are conducted. These consist mainly of three kinds:

1. Laboratory tests—which are valuable, as they give indications of possibilities—should not be taken as conclusive.

2. Field tests—wherein specimens of materials under observation are placed in the apparatus and actual service effects noted. These tests give valuable information, and are more dependable than laboratory tests.

3. Service tests—in which parts of equipment are made of the material under observation and placed in regular operation. Tests of this kind are conclusive, and yield reliable information, but consume more time.

Methods of combating corrosion and types of material used may be divided into groups such as:

1. Base metals.
2. Alloys.
3. Coatings.

Base Metals

Investigations of the use of base metals, or metals in their commercially pure state have included: iron, lead, tin, copper, nickel, zinc and aluminum. In general, these metals have limited uses in oil refining due to their physical characteristics. Lead, for example, has splendid corrosion resistant properties under many conditions, but its low melting point and low tensile strength confine its use to such service as tank linings, etc., or as a coating, either hot-dipped or sprayed by the Schoop process.

Cast iron has certain corrosion resisting properties, but its lack of ductility and low strength allow its use only in places free from pressure, shock or high temperature. It is widely used in pipe lines and low pressure condenser or cooling systems. Cases have been noted where pipe and condenser sections have retained their shape and general appearance, but were so affected by corrosion that practically all of the iron had leached out leaving a cheeselike substance composed mostly of graphite that could be easily cut with a pocket knife.

The variation of service life is aptly illustrated by cast iron condenser sections, which in use are submerged in sea water. At one location over four years service was noted; in another, six to eight months is the maximum.

The use of copper and nickel, in the commercially pure condition, is confined to a few locations, but holds an important place in alloying with other metals producing brasses, bronzes and alloy steels.

Aluminum has proved successful for electric conduits where exposed to moisture from cooling systems and in light gauge sheets for pipe line insulation jackets, but contact with caustic must be avoided.

The use of zinc is confined largely to coating other metals, but in light gauge sheets can be used successfully for pipe line insulation jackets and as siding or roofing. Its low melting point must be considered in locations where fires may occur.

Alloys

Alloys are divided into two classes: ferrous and nonferrous. The ferrous group includes those having iron as the base, with the addition of elements such as chromium, nickel, copper, molybdenum, tungsten, silicon, or various combinations of these elements. The noneferrous group includes metals having copper as a base, with additions of lead, tin, nickel, zinc, silicon, aluminum, and iron, giving brasses and bronzes of various kinds. Aluminum alloys, both cast and wrought, are included in this group.

In dealing with the ferrous alloys, it has been found that some have to be polished, while others require special heat treatment to bring out their desired corrosion resisting properties.

Experience has shown that the straight 18 per cent chromium alloy must be used with caution, due to its tendency to become very brittle when subject to prolonged or continued heating above 400° F. This characteristic also precludes welding, especially when the article is subject to shock or impact. Tubes and pressure vessel liners made of this metal became very brittle and cracked in high temperature service. Small tubes of this metal failed in five months in heat exchanger service at approximately 235° F. in contact with 34° A.P.I. heating oil. An impeller wheel in gas booster service corroded to destruction in about one week from contact with gases produced in oil distillation.

A successful application of this material was made in a topping still. A float used to indicate the liquid level has been in use more than two years, in spite of serious corrosion, where ordinary steel would last but six to eight months.

Some of the chromium-nickel (austenitic) alloys have several desirable characteristics, such as corrosion resistance, high creep stress at elevated temperatures, and lack of brittleness after gas welding; on the other hand, when properly heat-treated to obtain maximum corrosion resistance, their great ductility makes them susceptible to deformation. The difference in coefficient of expansion also makes their use precarious when used in combination with common steel.

Use in Tubes

The 18 per cent chromium-8 per cent nickel alloy is one of the most prominent of this type, and is coming into considerable use in the form of tubes. It resists corrosion remarkably well under temperature, but must be handled carefully during cleaning operations, as its ductility permits deformation in the form of bulges. This condition should be avoided, as the depression inside the tube allows coke formation which may cause localized overheating. Care must be exercised in rolling and flaring, as continued cold working without relieving mechanical stresses can cause ultimate cracking.

Alloys with high nickel content are evidently unstable in the presence of hydrogen sulphide, and are readily attacked; but the addition of chromium in correct proportions reduces this tendency to corrode. An example of this was noted wherein a 26 per cent nickel steel lost 30 per cent of its original weight in 1,030 hours; whereas an alloy containing 20 per cent nickel and 8 per cent chromium, which, in the form of cracking still plugs operating under high pressure and temperature, has been in service more than two years with no loss from corrosion.

Pump rods of this alloy handling hot bottoms from a still, orifice plates in 66° Be. sulphuric acid, valve trim in sour stock service, and sheave wheels on tank float gauges have also given good service. Failure has occurred, however, in a very short time when this material has been used in the form of wire rope and flat ribbon on tanks where good service has been obtained from sheave wheels of the same metal.

Corrosion Test

The effect of alloying elements in retarding corrosion was demonstrated in the corrosion test conducted recently for the American Petroleum Institute. In this test, plain carbon steel lost as much as 54 per cent of its original weight after 1,031 hours exposure in a cracking still. The 18 per cent chromium-8 per cent nickel alloy gave the best results. The 17 per cent chromium-7 per cent nickel-2.75 per cent aluminum alloy resisted corrosion, but became embrittled. The results seemed to indicate that increase in chromium content up to 20 per cent in straight chromium steels progressively increased resistance to corrosion.

Corrosion or oxide formation found inside of fire boxes calls for use of another type of alloy, the so-called heat-resistant material having in the neighborhood of 15 per cent chromium and 35 per cent nickel. This alloy is designed to resist scaling and oxidation from high temperature, and is used for furnace parts and tube supports quite successfully.

Copper base alloys producing brasses and bronzes of different kinds are used successfully under certain corrosive conditions, notably in dilute sulphuric acid service as valves, pipe and fittings where steel is readily attacked. As condenser bolts, submerged in sea water, good service has been derived over a period of more than 10 years, while common steel bolts are destroyed in less than eight months.

Small diameter thin walled tubes made of admiralty metal, an alloy of this group, are being used in condenser and heat exchanger units operating at low pressures with temperatures in the neighborhood of 350° F., and at this writing a more suitable metal to supplant it has not been found.

Aluminum has corrosion resisting qualities and is being alloyed with certain elements to impart strength which it normally lacks. It also possesses high heat conductivity, a feature which at times is desirable. A 5 per cent silicon-aluminum alloy was used in making condenser sections similar to the cast iron units in general use but did not prove successful. The failure was no doubt due in a large measure to electrolysis, which could not be avoided in spite of efforts made to do so. It is believed that better results would be obtained if an entire unit were made of such castings, but the expense involved is too great in view of the doubtful results.

Coatings

Coatings are often used successfully to impart to steel equipment that resistance to corrosion necessary under certain conditions and include many materials which can be arranged into two groups, metallic and nonmetallic.

Metallic coatings of zinc, cadmium, lead, tin aluminum, chromium, nickel and gold, are applied by such methods as hot dipping, spraying and electroplating.

Sprayed metallic coatings include practically any metal which can be drawn into wire.

Nonmetallic coatings include cement, rubber and the many kinds of paints, lacquers, varnishes, acid-proof enamels, cement and rubber.

Galvanizing has proven quite successful in resisting atmospheric corrosion and is inexpensive.

Lead coating has some advantages but in thin coats is often porous and ultimately fails as several tests have shown. In the heavier coats, however, there is a process whereby the lead is applied to steel that has a perfect bond and affords good protection against corrosion. Agitator roof doors have been in use for about two years successfully protected against severe corrosive conditions by a coating of this kind.

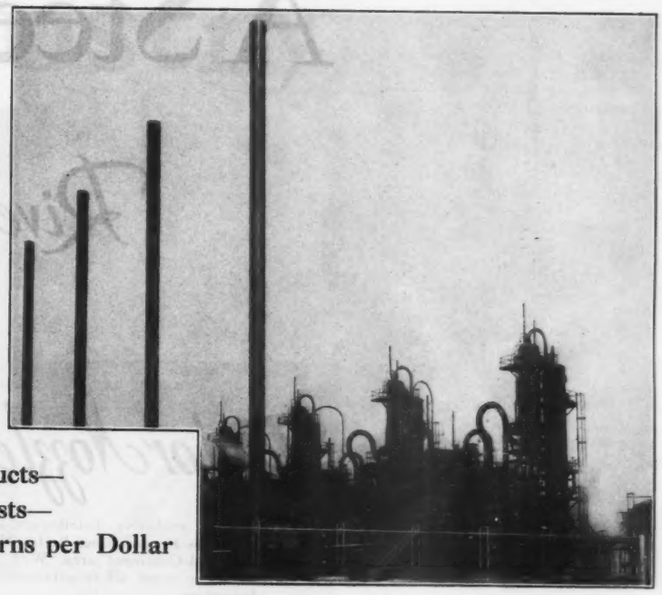
The Schoop process, which is a method of spraying molten metals to form a protective coating, has been used with some success on still bottoms and fire tubes in topping service. Several tests were conducted which demonstrated the ability of an aluminum coating applied by this process to increase the life of a still bottom by approximately 33 per cent. The speed of application of this coating is very slow as only a small area is covered by the spray. This makes the cost somewhat high. Abrasion will also damage this coating and permit localized attack of the parent metal.

Schoop process aluminum coating tried on the inside of several tanks produced failures which are attributed largely to

(Continued on Page 274)

*Before tenth annual meeting, American Petroleum Institute, Chicago, December 4, 1929.

JENKINS CRACKING PROCESS



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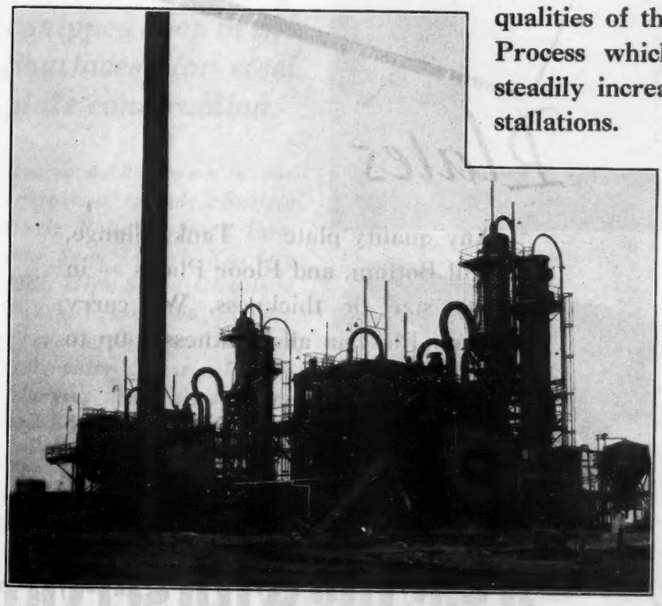

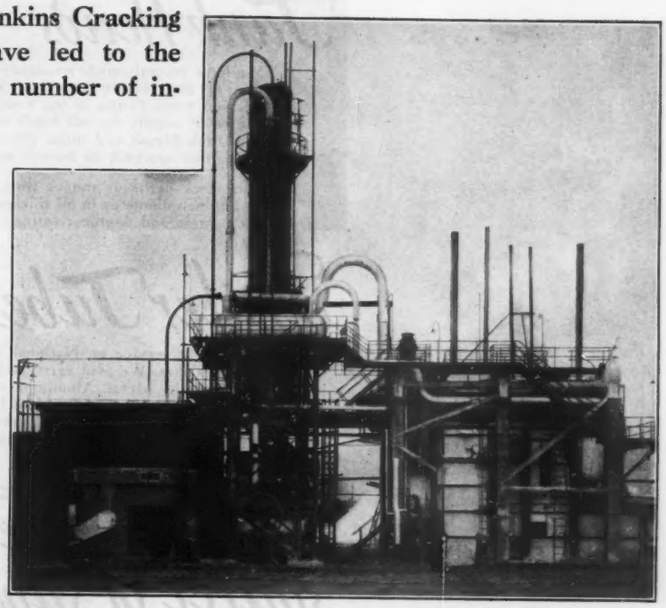

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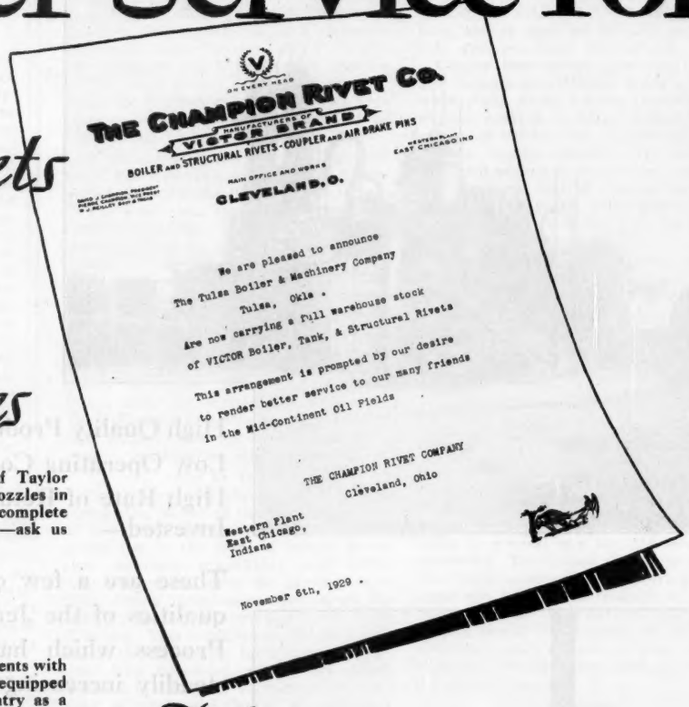
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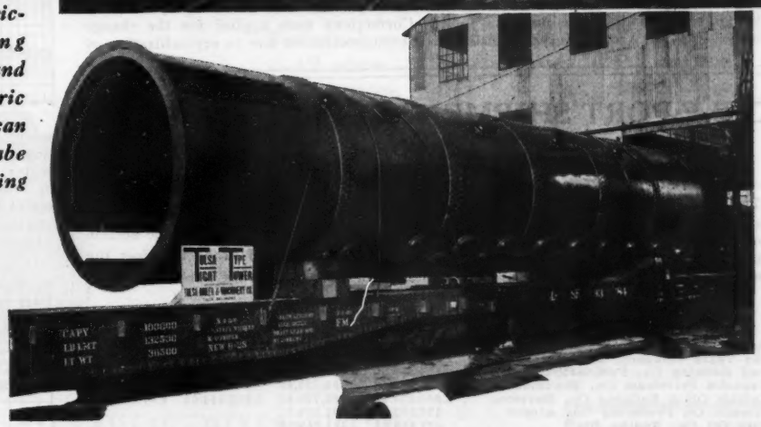

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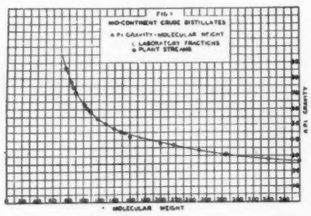
TANKS REFINING EQUIPMENT

Some Properties of Mid-Continent Crude

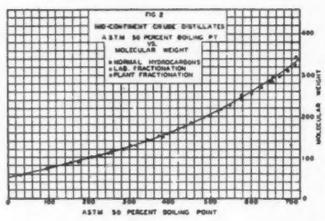
Correlation Between Molecular Weights and Several Properties of Mid-Continent Oil and Fractions Thereof

By Ogden Fitzsimmons and W. H. Bahlke
Standard Oil Co. (Indiana), Whiting, Ind.*

In many of the calculations necessary for the design of refinery equipment, the molecular weight of the substances under consideration is involved. The usual data available for the solution of a problem consist largely of data on such properties as A.S.T.M. distillations, gravity and viscosity. Correlation of these more easily determined physical properties and molecular weight would permit placing many of the calculations on a more certain basis. This paper presents a correlation between molecular weights and several properties of Mid-Continent crude and fractions thereof.

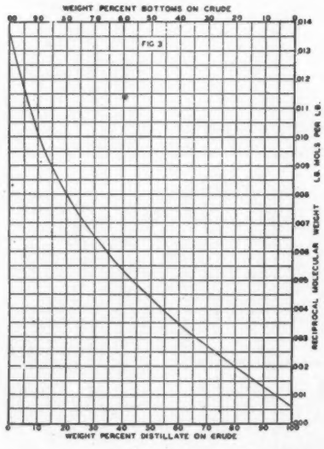


The data were obtained by determining the gravity, viscosity, A.S.T.M. distillations, and molecular weights on fractionated cuts from Mid-Continent crude. Some of the data were obtained from measurements on fractions prepared by laboratory fractional distillations, while others were obtained on refinery streams. The crude in all cases was an average Mid-Continent pipe line crude as received at Whiting.



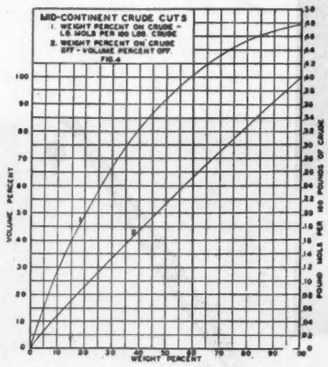
Experimental

To prepare the laboratory cuts, 2 gallons of crude were slowly distilled through an insulated Hempel column 2 feet high, packed with one-eighth-inch diameter Rashig rings. Heat was supplied to the column electrically, so that the tower top temperature lagged the still temperature by not more than 100° F. When the still temperature reached 540° F., about a 5 m.m. vacuum was applied and the distillation continued so that 70 per cent was obtained as distillate without heating the oil higher than 540° F. During the vacuum distillation, the tower top and still temperature differential was maintained at 100° F. At the start of the atmospheric pressure distillation, the condenser was cooled with carbon dioxide snow in alcohol to minimize gas losses. Fractions representing 2½ per cent of the crude were taken throughout the distillation.

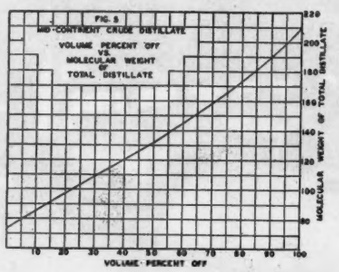


Portions of the wax-bearing distillates were dewaxed at —15° F. in 30 per cent naphtha solution, and the naphtha subsequently removed.

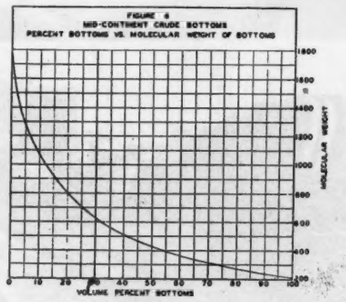
Gravity, viscosity, and A.S.T.M. distillations were obtained by the usual methods, checks being made in most cases. Molecular weights were determined in general by the cryoscopic method, although cross checks were made in some cases using the Victor Meyer vapor density and Menzies-Wright boiling point rise methods.

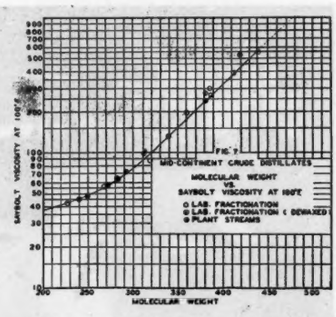

MID-CONTINENT CRUDE CUTS
1. WEIGHT PERCENT ON CRUDE = LB. MOLS PER 100 LBS. CRUDE
2. WEIGHT PERCENT ON CRUDE OFF = VOLUME PERCENT OFF.
FIG. 4
VOLUME PERCENT
POUND MOLS PER 100 POUNDS OF CRUDE
WEIGHT PERCENT

In the cryoscopic method of Beckmann, chemically pure benzol, dried over sodium, was thrice crystallized and used as solvent. Its freezing point was 5.45° C.



In all cases the substance under investigation was weighed on an analytical balance. Determinations were made at several molal concentrations varying between 0.5 and 7 per cent. At each concentration, several determinations were made at various degrees of supercooling. Corrections were applied for the change in concentration due to crystallization of benzol and for the change in apparent molecular weight with change in concentration due to association.





Some comparative values of determined molecular weight are shown in Table 1.

TABLE 1—COMPARISON OF MOLECULAR WEIGHTS BY VARIOUS METHODS

Sample No.	A.P.I. gravity	Molecular Weight — Cryoscopic method	Menzies method	Victor Meyer method
1	83.2	74.5	...	72.5
2	74.8	87.0	...	85.9
4	65.0	96.3	...	95.7
7	55.4	113.8	...	113.3
10	49.1	131.0	...	127.8
124	30.5	284.6	297	....
127	27.9	340.0	357	....
106	57.8	108.9	...	106.5
				112.5
130	24.3	416.0	422	....

Results

The correlation between molecular weight and other properties is shown in Figures 1 to 7.

Figure 1 shows the relationship between A.P.I. gravity and molecular weight. It is noteworthy that the molecular weight-gravity relationship for the crude (molecular weight 209, gravity 36.6 A.P.I.) is nearly identical with the relationship for the narrow cuts.

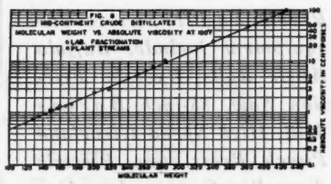


Figure 2 shows the relationship between A.S.T.M. 50 per cent point and molecular weight.

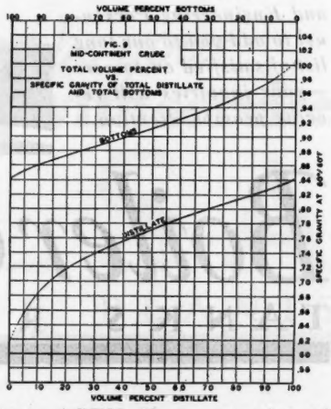


Figure 3 shows the relationship between reciprocal molecular weight and weight per cent for narrow cuts. For wide cuts the molecular weight must be

(Continued on Page 276)

*Before tenth annual meeting, American Petroleum Institute, Chicago, Ill., December 5, 1929.

GULF PORT SHIPMENTS DECLINE 148,411.48 BBLS. IN OCTOBER

HOUSTON, Tex., Nov. 30.—A total of 17,927,390.80 bbls. of crude and refined products were lifted out of Gulf Coast ports for coastwise and export shipment during October, according to figures just compiled here. This was a decrease of 148,411.48 bbls. from shipments of the preceding month. There was an increase in the movement of crude but the decline in liftings of refined products offset the crude again. Shipments were:

REFINED

Company and port—	Coastwise September	Coastwise October	Export September	Export October
Standard Oil Co. (La.), Baton Rouge	683,748.00	714,287.00	722,937.00	676,896.00
The Texas Company, Port Arthur	1,233,289.00	1,304,406.00	508,724.00	415,227.00
Gulf Refining Co., Port Arthur	2,124,455.50	2,695,029.25	122,491.00	100,046.12
Magnolia Petroleum Co., Beaumont	1,155,522.50	698,639.66	(*)	.....
Humble Oil & Refining Co., Baytown	2,002,034.48	1,265,720.60	1,872,544.03	1,874,680.98
Atlantic Oil Producing Co., Atreco	116,352.08	37,119.52	.....	.....
Pure Oil Co., Smiths Bluff	472,488.61	461,545.62	.....	.....
Deepwater Oil Refineries, Houston	.....	.....	.....	45,000.00
Total refined	7,687,890.17	7,176,747.65	3,226,696.03	3,111,850.10

CRUDE

Company and port—	Coastwise September	Coastwise October	Export September	Export October
Standard Oil Co. (La.), Baton Rouge	355,784.00	753,705.00	53,754.00	53,927.00
The Texas Company, Port Arthur	.....	.....	.....	.....
Gulf Refining Co., Port Arthur	218,285.28	223,698.27	.....	.....
Magnolia Petroleum Co., Beaumont	873,598.02	927,783.34	.....	.....
Humble Oil & Refining Co., Texas City	832,969.00	894,572.00	.....	.....
Ingleside	66,570.00	145,749.00	.....	.....
Baytown	456,153.00	262,369.00	.....	.....
Neches	.....	.....	.....	.....
Harbor Island	1,630,955.00	1,352,918.00	301,338.00	513,327.00
Atlantic Oil Producing Co., Atreco	1,206,300.05	1,030,687.35	.....	.....
Beaumont	142,753.45	158,286.34	.....	.....
Smiths Bluff	.....	37,510.54	.....	.....
Pure Oil Co., Smiths Bluff	349,810.28	458,265.21	.....	.....
Sun Oil Co., Sabine Pass	671,946.00	825,995.00	.....	.....
Total crude	6,806,124.08	7,071,539.05	355,092.00	567,254.00
Total shipments	14,494,014.25	14,248,286.70	3,581,788.03	3,679,104.10

*Magnolia Petroleum Co. makes no distinction in reports between coastwise and export shipments.

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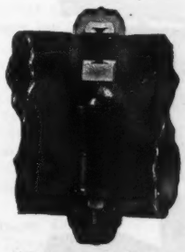

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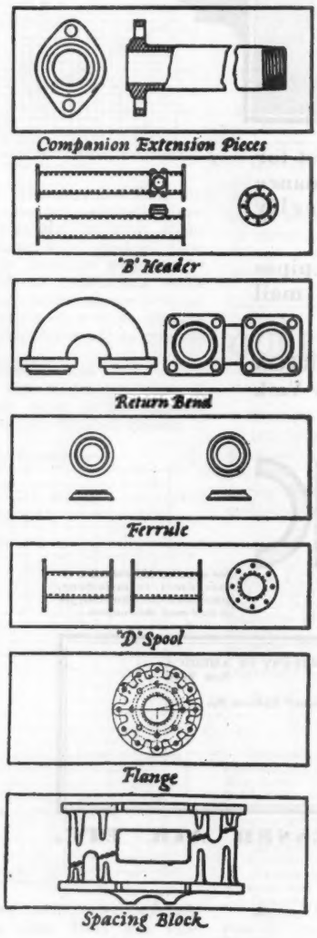

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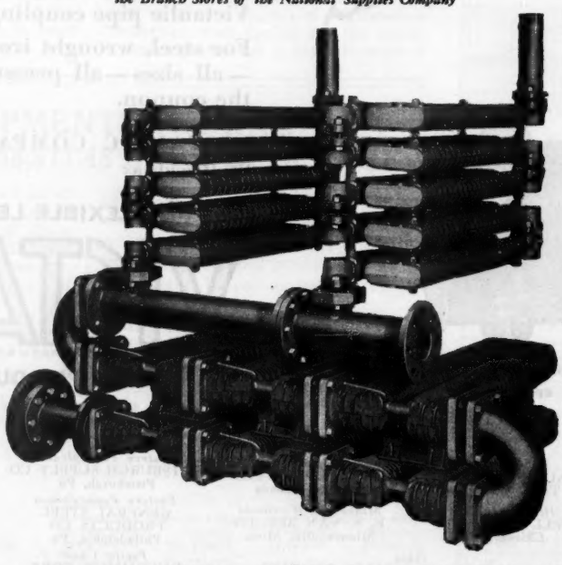

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CAUSE OF CORROSION IN CRACKING PLANTS

(Continued from Page 120)

case why we were able to draw out of the tube an appreciable quantity of sulphur, because at the surface there is an equilibrium reached between the three reactions above mentioned, which prevents the free sulphur from reacting completely with the iron.

In addition, it will be recalled that the heat of formation of H_2S being very small, its dissociation is very easy.

Also, it is known that above 832° F. (445° C.) the vapor pressure of free sulphur increases very rapidly with the temperature, being 760 m.m. at 832° F. (445° C.), 1,635 m.m. at 932° F. (500° C.).

When the experiment was completed and the tube opened after cooling, the strips showed an appreciable corrosion, the polished side being more attacked than the unpolished one, although this side was also covered with scale of iron sulphide. In places, there were some spots of grayish color, but beneath these spots the black sulphide appeared as everywhere else.

2. Action of Sulphur Dioxide

Like hydrogen sulphide, sulphur dioxide dissociates, but to a smaller extent, the temperature of the experiment being only near the start of its dissociation. While we were able to draw out some free sulphur, and there was some free sulphur deposited on the sides of the tube, it was in a much smaller quantity than in the case of hydrogen sulphide.

But a fact of interest is that at the temperature of 900° F. (which is perhaps 50° F. higher than the hottest part of the chamber at the start of the steaming of the reaction chamber in the cracking plant), sulphur dioxide acts both as an oxidizing agent and as a sulphurizing agent on iron and steel, yielding a mixture of ferric oxide and iron sulphide, as it appeared when we opened the tube.

Another point of interest is that hydrogen sulphide and sulphur dioxide will not react upon each other when dry (which is the case during the cracking), but when wet, react easily to yield free sulphur. So free sulphur from the reaction of hydrogen sulphide and sulphur dioxide must not be looked for during the cracking in the reaction chamber, the vapor line, the bottom of the dephlegmator and the dephlegmator leg where, as it will be shown later, no water was found to be present. But this reaction can, and must, take place during the steaming at the shutdown in the pipes leading to the condensing apparatus in the receiver, separator and rundown tanks, where sulphur is absorbed to a certain extent by the pressure distillate. Therefore, part of the free sulphur formed during the cracking period at 900° F. must be formed by the decomposition of hydrogen sulphide and of sulphur dioxide if the latter is present, which has not been ascertained.

3. Action of Hydrogen Chloride

It is stated in the literature that in the dry state hydrogen chloride will not react upon iron, and although we dried this gas with special care, passing it in turn through sulphuric acid, fuming sulphuric acid, concentrated sulphuric acid and two U-tubes filled with anhydrous calcium chloride, we found when opening the tube after the experiment was completed that a slight attack had taken place. However, the strips did not show the slightest attack on the rough surfaces which are protected by a thin coat of oxide, and the attack on the polished surfaces did not cover all of the exposed surface, as in the former cases.

On the other hand, the fact mentioned in the literature that hydrogen chloride can give only ferrous chloride, $FeCl_2$, was confirmed by the examination of the scale recovered from the strips, which were soluble in distilled water, but did not give any of the reactions of ferric chloride, $FeCl_3$.

B. Second Series: Experiments Using Free Sulphur, Naphthenic Acid, Sodium Chloride, and Hexahydrated Magnesium Chloride.

Apparatus — The apparatus employed in the first series was simplified, consisting only of a pyrex combustion tube sealed at one end, the other end being closed with a two-hole rubber stopper connected as before with an air aspirator and with a manometer for control of the pressure inside the combustion tube.

For the experiment with a chemical of this class, the reagent and the strips were introduced in the tube, which was then connected with a powerful vacuum pump to exhaust the air as completely as possible; then the vacuum pump was disconnected and the connections made as explained above. While heating the tube slowly, control of the pressure developed inside the tube was obtained by the manometer, and the pressure was released when necessary as in the first class of experiments to keep atmospheric pressure inside of the tube.

Comments on the Experiments

Action of Free Sulphur — Because flowers of sulphur contains a small amount of moisture, it was necessary to dry it by melting the sulphur in the reaction tube while applying the vacuum to remove all the water liberated as vapor. The temperature of 440° F. was kept for one-half hour, and the sulphur used amounted to 3 g. During the first five minutes some water was noticed in the cold part of the evacuating line, and thereafter no more water appeared, but we kept this temperature one-half hour to be absolutely sure of the drying.

The tube, being then completely closed by turning off the stopcock on the vacuum line, was allowed to cool to room temperature, when the tube was opened to introduce the strips of iron and steel. After this, the tube was again evacuated before heating.

After the experiment had been completed, the strips appeared covered with a thick black scale of iron sulphide with a few spots of silvery-gray material as in the case of hydrogen sulphide.

As we have already mentioned, the vapor pressure of free sulphur is quite considerable, and this naturally caused an increased pressure in the closed tube, thus favoring the combination of iron with sulphur. In this regard, it will be noted that the higher the pressure in a cracking unit, the greater this reaction will be favored.

As will be seen in Table 1, the corrosive action of free sulphur is by far more severe than that of any of the other chemicals tested, and this reinforces our explanation of the mechanism of the action of sulphur compounds. In other words, these sulphur compounds will react in a general way in the proportion that they yield free sulphur.

Action of Naphthenic Acids — Since charging stocks of cracking plants contain more or less organic acids belonging mainly to the series of so-called naphthenic acids, we tested their action on iron and steel.

To prepare naphthenic acids, as pure as conveniently possible, we concentrated crude naphthenic acids obtained from California, by saponification, decantation of the soaps formed, and liberation of the free acids by means of hydrochloric acid—this treatment being repeated twice. The naphthenic acids so obtained were dark and extremely viscous. They were dried thoroughly in a partial vacuum at 360° F., nothing distilling below 400° F.; then we distilled them under 5 m.m. absolute pressure, obtaining a light colored, though quite viscous oil.

Five grams of these acids were then used for the experiment, and although part of the strips were in the direct contact with the acids, no attack was noticeable when we opened the tube. Only a thin deposit of carbon indicated that some decomposition had taken place which resulted in a less viscous oil than the one with which we started.

Action of Sodium Chloride

Sodium chloride, perfectly dried, was allowed to react for 24 hours and showed

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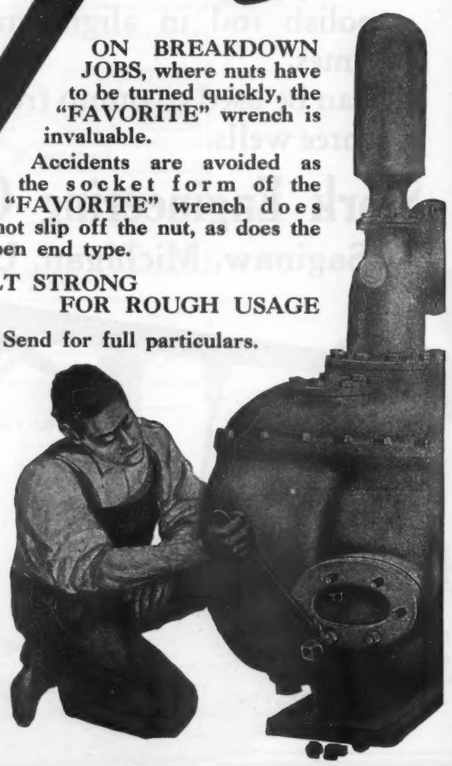

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at 900° F. no dissociation nor corrosive action on the strips.

Action of Magnesium Chloride — Hydrated magnesium chloride ($MgCl_2.6H_2O$) is the stable form of magnesium chloride at ordinary temperature, and is the one likely to be present in the crudes. Its decomposition takes place according to the following reactions:

$MgCl_2.6H_2O = MgCl_2.4H_2O + 2H_2O$ and so on until all of the water has been separated from the chloride. Then we have:

1. $MgCl_2 + 2H_2O = Mg(OH)_2 + 2HCl$

and by further heating:

2. $Mg(OH)_2 = MgO + H_2O$

and possibly:

3. $MgCl_2 + H_2O = Mg(OH)Cl + HCl$

as an intermediate reaction to the formation of the oxychloride yielded by further heating:

4. $2Mg(OH)Cl = Mg\begin{matrix}-Cl \\ -O-\end{matrix}\!\!>\!\!Mg\begin{matrix}Cl- \\ -\end{matrix} + H_2O$

The Reactions 1 and 2 start when the temperature reaches 223° F., and Reactions 3 and 4 when the temperature exceeds 366° F.

The hydrated magnesium chloride yields then magnesia or its oxychloride, which by the action of steam, will never liberate hydrochloric acid. Therefore, the possibility of obtaining some hydrochloric acid at the moment of steaming the coke at the shutdown of the cracking plants seems doubtful, even admitting that the chloride of magnesium would be found in the charging stock of the cracking plant in the form of its hexahydrate, despite the fact that this charging stock has already passed through the topping plant units. The temperature of the charging stock for the cracking units is kept above 700° F. from the moment it passes the bottom of the dephlegmator to the moment it returns there after having been brought to as high a temperature as 925° F., and thus the only reactions that must be taken into consideration are the Reactions 2 and 4, since the temperature of 366° F. is greatly exceeded in the dephlegmator, through which nearly all the oil passes before entering the system.

Nevertheless, we have tried the action of hydrated magnesium chloride in the tube closed as described before, and we have observed that:

a. $MgCl_2.6H_2O$ is dissociated, thus forming hydrochloric acid which we could drive out and identify by silver nitrate solution.

b. The product of reaction on iron and steel was ferrous chloride only, which was partly driven off, showing its volatility.

c. The resulting corrosion was extremely small.

These observations are a confirmation of the indications found in the literature.

C. Third Series: Experiments Using Ethyl and Butyl Disulphides, Anhydrous Magnesium Chloride, and Magnesium Oxychloride.

For studying the action of ethyl and normal butyl disulphides, it was thought advisable to operate under the pressure developed in the combustion tube in order to keep the materials being tested or their products in the tube. We also studied in the same way the action of anhydrous magnesium chloride and of its oxychloride ($Mg_2O\ Cl_2$).

In this series of experiments, after introducing the reagent and the strips in a pyrex combustion tube sealed at one end, the tube was exhausted of air by means of a vacuum pump and the other end sealed. In the case of the liquid organic disulphides, this procedure made sure that no air was left. The completely sealed tube was then heated slowly to about 900° F., the former experiments having made possible to regulate quite accurately the temperature with the slide of the rheostat.

Comments on the Experiments

Action of Normal Butyl Disulphide—This product contained a small amount of normal butyl mercaptan, which imparted to the disulphide a strong garlic-like odor, and gave a positive doctor test. About 3 c.c. of this compound was placed in the sealed tube, which was exhausted of all the air previous to the sealing, this exhaustion having had the effect of vaporizing part of the disulphide. On account of this vaporization the atmosphere was more easily made free from air, but the amount of the reacting material was at the same time lessened.

However, after the experiment was completed, all the strips showed some corrosion and were more or less covered with black iron sulphide.

On opening the tube, we found a small deposit of carbon resulting from cracking and a few droplets of liquid on the walls of the tube; but all odor had disappeared, showing that the mercaptan had been destroyed.

From the calculation of the total sulphur put into reaction as disulphide and from the weight of scale recovered as FeS, it appears that almost all of the organic disulphide had been destroyed to yield sulphur and hydrocarbons.

Action of Ethyl Disulphide—The same results were obtained as with the normal butyl disulphide, with the exception that there was no carbon formed during the cracking of this compound. The strong odor of mercaptan of the original product had also completely disappeared, and the only sign of the reaction was the scale of ferrous sulphide formed on the strips, showing as in the preceding case that almost all the sulphur had been taken from the organic compound by the iron.

Action of Anhydrous Magnesium Chloride ($MgCl_2$)—This compound could not be found on the market and it was prepared for our experiments. In as much as anhydrous magnesium chloride would not be found in oil, this experiment is more of scientific than of practical interest. The results showed that there was some dissociation which led to the formation of ferric chloride as expected, the reaction being in this case:

$$MgCl_2 \rightleftarrows Mg + Cl_2$$

and the action of chlorine on iron leading to the ferric salt.

Action of Magnesium Oxychloride — The experiment showed absolutely no corrosion, confirming the statement of Roscoe and Shorlemmer.

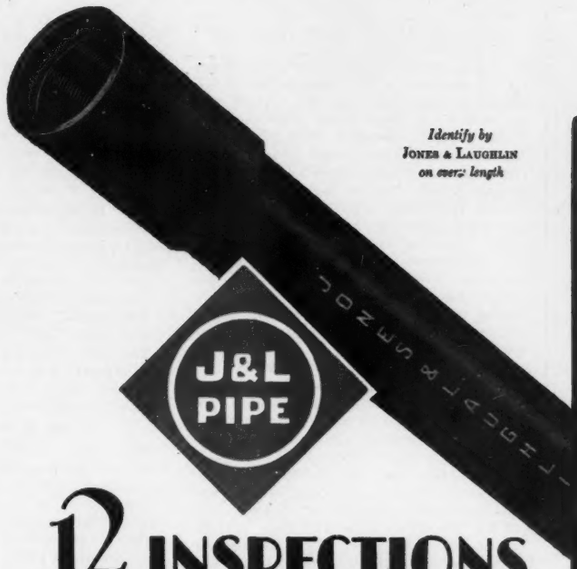
Resume of the Experimental Data

All the numerical data have been put together in Table 1 for easy comparison. It should be pointed out that the lack of corrosion losses does not necessarily mean that there was no attack, for in some cases the quantity of material tested was too small. For instance, in the case of the organic disulphides, the

TABLE 1—CORROSION OF IRON AND STEEL BY VARIOUS CHEMICALS AT 900° F.

	Resulting Corrosion in Pct. Loss by Weight			
	Nonpolished		Polished	
Chemical—	Wrought iron Per cent	Steel Per cent	Wrought iron Per cent	Steel Per cent
H_2S	0.9	1.1	2.0	2.3
SO_2	0.1	Trace	1.2	4.4
HCl	*	*	0.24	1.0
S	5.5	4.5	6.5	10.7
Naphthenic acids	*	*	*	*
n-Butyl-disulphide	Trace	Trace	1.8	0.6
Ethyl disulphide	Trace	0.5	0.2	0.8
NaCl	*	*	*	*
$MgCl_2.6H_2O$	0.1	0.2	0.2	0.4
Mg_2OCl_2	*	*	*	*
$MgCl_2$	0.2	0.3	Trace	0.2

*Indicates no scale.



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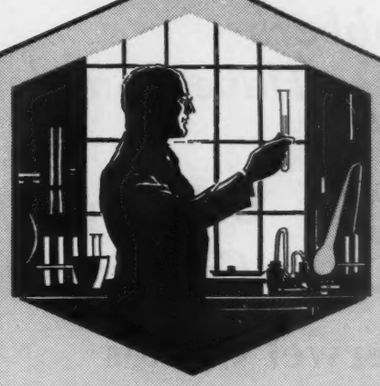

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4 Ingots rolled into blooms under temperature control.

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7 Ends trimmed; then pipe is inspected for wall thickness and correct outside diameter and roundness.

8 Pipe threads checked with certified gages and second inspection made for flaws, to insure clean cut accurate threads of proper pitch and taper.

9 Couplings as produced in our mills are closely inspected for correct tapping, threads accurately gaged for pitch and taper and checked on specially designed machines for alignment.

10 All items of previous inspections rechecked on testing benches, and stencil marks applied.

11 Each length given hydrostatic pressure test before rust-resisting coating is applied and pipe is delivered to shipping platform.

12 Final inspection of each length as it is loaded for shipment.

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attack is evidenced by the action on the polished strips, and on account of the small amount of disulphides used the liberated sulphur was naturally first absorbed by the more reactive polished strips, and there was not enough sulphur in reaction to attack all of the strips. On the other hand, in the case of hydrochloric acid, sodium chloride, and magnesium chloride, there was a great excess of reagent.

The main fact evidenced in these series of experiments is the dissociation of hydrogen sulphide and organic sulphur compounds (in a closed tube). This indicates that, in plant operation, these compounds will be partly decomposed, yielding some free sulphur whose corrosive action surpasses by far that of all the other corrosive chemicals possibly present in the charging stock. It will be noticed that while the surface of metal in the cracking equipment is not polished, it is not, however, protected by a coating of oxidized iron; so that the corrosion of the metal in the cracking unit should be expected to be intermediate to the above figures.

Corrosion in Cracking Plants

In the preceding pages, the influence of free sulphur has been shown to be greater than that of any other substance which we tried at the temperature of cracking. At the shutdown of the cracking unit, the cooling of the reaction chamber is effected by injecting steam, and the reactions taking place in this stage of the operation have also been investigated. It was found that, during the steaming, part of the free sulphur and sulphides contained in the coke was transformed into hydrogen sulphide, and also that a very small quantity of sulphur dioxide was formed, the latter having proved to be corrosive to iron and steel when dry and hot, as well as in the presence of water vapor. Sulphurous acid ions have been found in the condensate from the vapors from the cracking units, thus confirming our laboratory results.

Examination of Scale

Estimation of the corrosion by the loss of weight does not give any indication as to the cause of this corrosion, and we believe that the nature of the products of corrosion should be determined whenever feasible. For instance, in the case of corrosion by sulphur dioxide, examination reveals that this compound has acted both as oxidizing and sulphurizing agent.

During the replacement of plates from two different dephlegmators, scale was collected at various places and analyzed. The bottom plates of these dephlegmators, just next to the incoming vapor line from the reaction chamber, were so corroded that their thickness had been reduced to that of a razor blade, especially at the periphery; the plates are less and less corroded farther up in the dephlegmator, this being just the opposite of what would happen if the corrosion were due to hydrochloric acid.

We give in Table 2 below the results of the analysis:

TABLE 2—ANALYSIS OF SCALE FROM CRACKING UNITS

Constituent—	Depnegmator No. 8 bottom plates Pct.	Deplegmator No. 16 2d plate from bottom Pct.	Deplegmator No. 16 4th plate from bottom Pct.
S	24.4	15.3	12.1
Cl	0.4	0.7	1.0
Fe	42.8	26.9	20.8
Mg, Na (by difference)	0.3	0.6	0.9
Insoluble in water	32.1	47.8	48.0
Volatile matter and moisture	0.0	8.7	17.2
	100.0	100.0	100.0
Approximate Constitution of Scale			
FeS	66.9	42.1	32.4
Fe_2O_3	0.3	0.1	0.5
NaCl-$MgCl_2$	0.7	1.3	1.9
Volatile and insoluble	32.1	56.5	65.2

We have attributed the chlorine in this table to the magnesium and sodium, because by boiling 100 g. of scale with distilled water, even under reflux for an hour, it has been impossible to detect the presence of iron in the aqueous solution, notwithstanding the sensitiveness of the reagents for iron. The small amount of chlorine present is very easily explainable by the presence of the carbonaceous matter in the scale which retains naturally some inorganic solid matter.

Table 2 is self-explanatory, and confirms all that has been said before. We desire to emphasize, however, the following points:

1. The quantities of iron and sulphur found are almost the theoretical ones for iron sulphide.
2. No iron is present in soluble form.
3. Traces of magnesium, neutrality of the aqueous solution and presence of sodium indicate that chlorides have not attacked the iron of the cracking plant.

It seems, therefore, logical to conclude that most, if not all, corrosion is sulphur corrosion.

Explanation of Corrosion

In addition to corrosion of the dephlegmator plates, and also of the bottom wall, especially the part opposite the incoming vapor line, corrosion is found in:

The tubes in the furnace,
The reaction chamber,
The vapor line,
The reflux line and hot oil pump piping.

The transfer line connecting the furnace with the reaction chamber does not show as much corrosion.

Tubes in the Furnace

The most corroded tubes, including here the additional destruction of the material mostly due to erosion, are not the hottest ones, as would seem logical at first. They are located a little above the middle bank, and an attempt to explain this fact is as follows: As shown in the first part of this work, the organic sulphur compounds yield by cracking some free sulphur, and it is probable that this decomopsition takes place in these tubes where the temperature is an optimum. This free sulphur, being in the nascent state, has probably a greater reactivity and combines immediately when in contact with the tubes to form iron sulphide.

Reaction Chamber and Vapor Line

In the reaction chamber, the cracking is completed, yielding more hydrogen sulphide and free sulphur. Part of the free sulphur is vaporized and driven out with the vapors, together with the hydrogen sulphide. The contact of these corrosive agents with the metal is, therefore, more intimate and lasts for a longer time than if these agents were in solution in the oil. Also the reaction chamber and vapor line are submitted to the action of the moistened hydrogen sulphide and sulphur dioxide during the steaming and the resulting corrosion is quite large.

Reflux Line and Hot Oil Pump Lines

As in the case of the dephlegmator, the corrosion is considerable in these parts, because the incoming oil absorbs part of the corrosive agents from the vapors, thus increasing its content of hydrogen sulphide and free sulphur.

Incidentally, while it happens that sometimes water vapor is carried on all through the system, we believe that this is not normally the case. We noted that the charging stock used for the two runs under examination was completely freed from any moisture by passing through the dephlegmator, which is not surprising. In fact, the daily samples taken during these two runs, as well as the composite samples for the two runs made in the plant, did not show any trace of moisture by the usual determination.

The corrosion of the reflux line is increased during the steaming of the chamber, but the fact that the hot oil pump lines are not steamed but are corroded, shows that corrosion also takes place during the hot period.

Summary of Results

A study of the corrosion of the cracking equipment is described from both a theoretical and practical standpoint, the laboratory experiments being verified during the plant operation. It has been demonstrated that:

1. During the cracking, several sulphur compounds yield free sulphur.
2. At the temperature of cracking, free sulphur has much more reactivity than any of the other chemicals tested.
3. During the steaming of the plant, hydrogen sulphide and sulphur dioxide are formed and are present in the vapors

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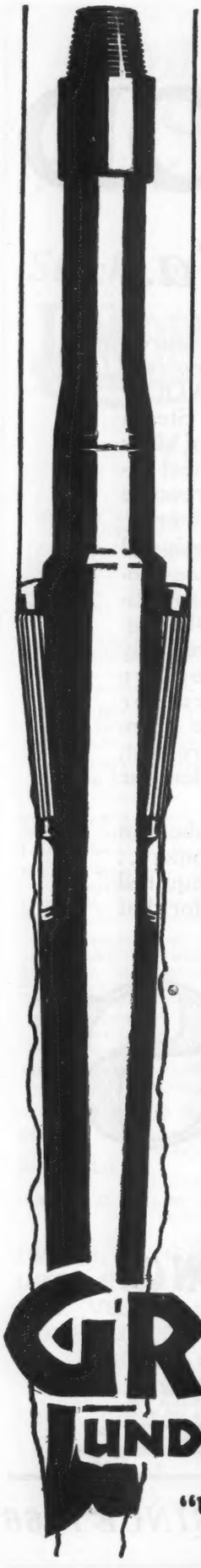

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passing through the vapor line, dephlegmator and reflux line.

4. During the steaming of the reaction chamber, there is no hydrochloric acid formed because there are no "hydrolyzable" chlorides present. The chlorides present are NaCl and possibly magnesium oxychloride, which under the conditions of operation are not decomposed.

5. At no time has it been possible to find an appreciable amount of chlorine ion in any of the samples taken and examined, and when a trace was found it has been shown that it was not due to free hydrochloric acid but to sodium or other neutral chlorides in the scale or carried out mechanically with the vapors.

6. In view of the fact that no hydrochloric acid was found during the cracking period or steaming period, and because of the relative inertness of the organic acids at the reaction temperature, we feel that we have demonstrated that the chief cause of corrosion of cracking units is sulphur or sulphuric compounds.

Conclusion

1. In cracking plants using a sulphur-bearing charging stock, it seems that corrosion is mainly due to the action of elementary sulphur during the period of cracking, with an additional corrosion by hydrogen sulphide and sulphur dioxide taking place during the steaming period when the plant is being shut down.

2. The mechanism of corrosion seems to be the decomposition of organic sulphur compounds, liberating hydrogen sulphide, which in turn is decomposed at the temperatures employed, into hydrogen and elementary sulphur. The elementary sulphur then attacks the steel.

WILDCAT OPERATIONS IN OKLAHOMA

(Descriptions are East and North unless marked otherwise)

(Continued from Page 66)

HASKELL COUNTY

Holden's No. 1 Phillip, SE cor. Sec. 3-9-18e .....Shut down 1,200 ft.
Marion Oil's No. 1 Sanders, NW NE SW Sec. 10-9-18e..Shut down 2,387 ft.
Sanbolse Gas' No. 1 Unknown, SW NW SE Sec. 32-9-21e..Shut down 2,100 ft.

HUGHES COUNTY

Wright et al's No. 1 Ott, SE SW Sec. 15-5-11 .....Rig.
Canady et al's No. 1 Kanard, NW SW Sec. 29-9-12 .....Drlg. 1,575 ft.
Irwin et al's No. 1 Jones, SE NW Sec. 30-5-10 .....Rig on ground.
McCullough Oil Co.'s No. 1 Scott, NW NE Sec. 23-6-8 ....Fishing 4,600 ft.

JACKSON COUNTY

Altus Oil Co.'s No. 1 Northington, NE cor. NE Sec. 4-1-20w .....Shut down 2,020 ft.

KINGFISHER COUNTY

Superior Oil Co.'s No. 1 Story, SE cor. Sec. 25-19-5w ....Fishing 6,285 ft.
Gait Brown's No. 1 Wolf, NW SE Sec. 6-16-7w .....Shut down 6,015 ft.

KIOWA COUNTY

Hyde et al's No. 1 Jones, SE cor. Sec. 23-3-18w-50 .....Shut down 490 ft.
Merrick Oil Co.'s No. 1 Kelly, NW cor. SE Sec. 20-7-17w..Drlg. 1,272 ft.

LEFORE COUNTY

Red Bank Oil Co.'s No. 1 fee, SE SW NW Sec. 23-9-24..Drlg. 5,400 ft.; 15,000,000 ft. gas; rig burned; building rig.

LATTIMER COUNTY

Limestone O. & G. Co.'s No. 1 Shaw, NW cor. NE NW Sec. 23-5-18e .....Shut down 1,450 ft.
Limestone Oil & Gas Co.'s No. 1 McMurray, SW cor. SW Sec. 15-5-18 .....Fishing 4,020 ft.

LINCOLN COUNTY

Morgan & Flynn's No. 1 Johnson, SW NE Sec. 1-16-5 ....Drlg. 2,525 ft.
Phillips Pet. Co.'s No. 1 Stephens, SE cor. NW Sec. 29-12-3 .....Rigging up standard tools; 5,100 ft.

LOGAN COUNTY

Haley & Smith's No. 1 Guier, SE cor. SW Sec. 33-18-3w..Shut down 2,970 ft.

McINTOSH COUNTY

Jennings Bros.' No. 1 Crabtree, NW SW NE Sec. 31-10-14 .....Drlg. 1,730 ft.
Patterson and others' No. 1 Smith, SW cor. NW SE Sec. 32-9-16 .....Shot 240 qts. 5,446-5,559 ft.; shot went off up hole; fishing.

MAJOR COUNTY

Earl and others' No. 1 Turner, C NE NE Sec. 23-20-14w..Rig; abandoned.

MUSKOGEE COUNTY

Sessions' No. 1 Richard, SE cor. SW Sec. 29-13-19 .....Rig.
Mid-Western Oil Co.'s No. 1 Unknown, C NW SW Sec. 31-12-19 .....Location.
Sioux Oil Co.'s No. 1 Unknown, NW SE Sec. 21-11-19 ....Shut down 1,011 ft.
Cooper-Badget's No. 1 Young, NW NE NE Sec. 7-12-20e ..Shut down 50 ft.

NOBLE COUNTY

Peerless et al's No. 1 Wentz, NW SW Sec. 22-22-1 .....Drlg. 2,480 ft.

OSAGE COUNTY

Lewis Prod. Co.'s No. 1, NW cor. Sec. 23-26-7 .....Drlg. 1,030 ft.

OKFUSKEE COUNTY

Henry Oil Co.'s No. 1 Harjo, Sec. 36-12-9 .....Shut down 2,795 ft.
Prairie's No. 1 Smith, SW NW Sec. 18-12-10 .....Wilcox sand 3,924-49 ft.; hole full water; abandoned.
E. L. Robinson's No. 1 Rice, NW Sec. 2-10-9 .....Location.
Shepard et al's No. 1 Neveas, SE NW SW Sec. 3-12-10 ..Drlg. 3,607 ft.

OKLAHOMA COUNTY

Ryan & Martin's No. 1 Lawton, NE NW Sec. 3-11-2w ..Drlg. 2,375 ft.
Tom Slick Oil Co.'s No. 1 Martin, C NW NW Sec. 13-13-1w .....Coring 6,125-35 ft.
Hall & Briscoe's No. 1 Holmes, NE cor. SW SE Sec. 10-11-3w .....Fishing 4,750 ft.

PITTSBURG COUNTY

Mid-Western Oil Co.'s No. 1 Unknown, SE SW NE Sec. 11-7-18 .....Spudding.
Empire O. & R. Co.'s No. 1 Williams, C NE SE Sec. 33-7-16e .....Pulling 10-in. csg. 3,100 ft.
Kerr & Koy's No. 1 Hall, C NW NW Sec. 32-4-12 .....Drlg. 3,300 ft.

PONTOTOC COUNTY

Indian Territory Illuminating Oil Co.'s No. 1 McFarland, NW cor. Sec. 4-5-5 .....Wilcox 3,142-45 ft.; cleaning out.
Independent and Shaffer's No. 1 Moses, NE SE SW Sec. 10-5-4 .....Wilcox 3,332-41 ft.; show water; plugging back.

POTTAWATOMIE COUNTY

Keister & Manning's No. 1 Rowlett, SW SE NE Sec. 30-8-4 .....Rig.
Payne Drlg. Co.'s No. 1 Bullock, SE NE Sec. 22-6-3 ....Drlg. 2,485 ft.
Lippa Drlg. Co.'s No. 1 Pittman, SW NW Sec. 3-8-4 ....Drlg. 4,100 ft.
Twin State's No. 1 Ray, NW SW Sec. 3-8-4 .....Drlg. 3,470 ft.
Prairie O. & G. Co.'s No. 1 Bodkin, SW cor. Sec. 26-8-4 ..Drlg. 3,869 ft.
Keister & Manning's No. 1 Tibbs, NE SW Sec. 9-8-4 ....Drlg. Hunton 4,450-55 ft.; dry.
Amerada's No. 1 Vineyard, NW NE NE Sec. 15-7-3 ....Shut down 5,041 ft.; hole full water 5,093 ft.; plugged back to 4,375-4,450 ft.; made 180 bbls.; completed.
Gypsy Oil Co.'s No. 1 Randolph, NW NE Sec. 23-6-4....Simpson 4,020-60 ft.; hole full water; abandoned.

ROGER MILLS COUNTY

Prairie O. & G. Co.'s No. 1 Mingo, SE NE Sec. 25-6-5 ..Drlg. 2,766 ft.
Bucy & Stone's No. 1 Williams, C SW Sec. 23-12-24w ....Rig.
L. C. Hivick's No. 1 Davis, C NW NE Sec. 4-11-26w ....Shut down 1,300 ft.

SEMINOLE COUNTY

Prairie O. & G. Co.'s No. 1 Harjo, NE SW NE Sec. 25-6-7 .....Drlg. 1,895 ft.
Sunray Oil Co.'s No. 1 Sunday, NW SE Sec. 25-5-5 .....Location.
Harris' No. 1 Harjoche, SE NE SE Sec. 8-6-6 .....Wilcox 4,047-52 ft.; plugged back to 2,950 ft.; swabbed 320 bbls.

SEQUOYAH COUNTY

Hunt and others' No. 1 Unknown, SE cor. NW SW Sec. 12-12-22 .....Shut down 1,260 ft.

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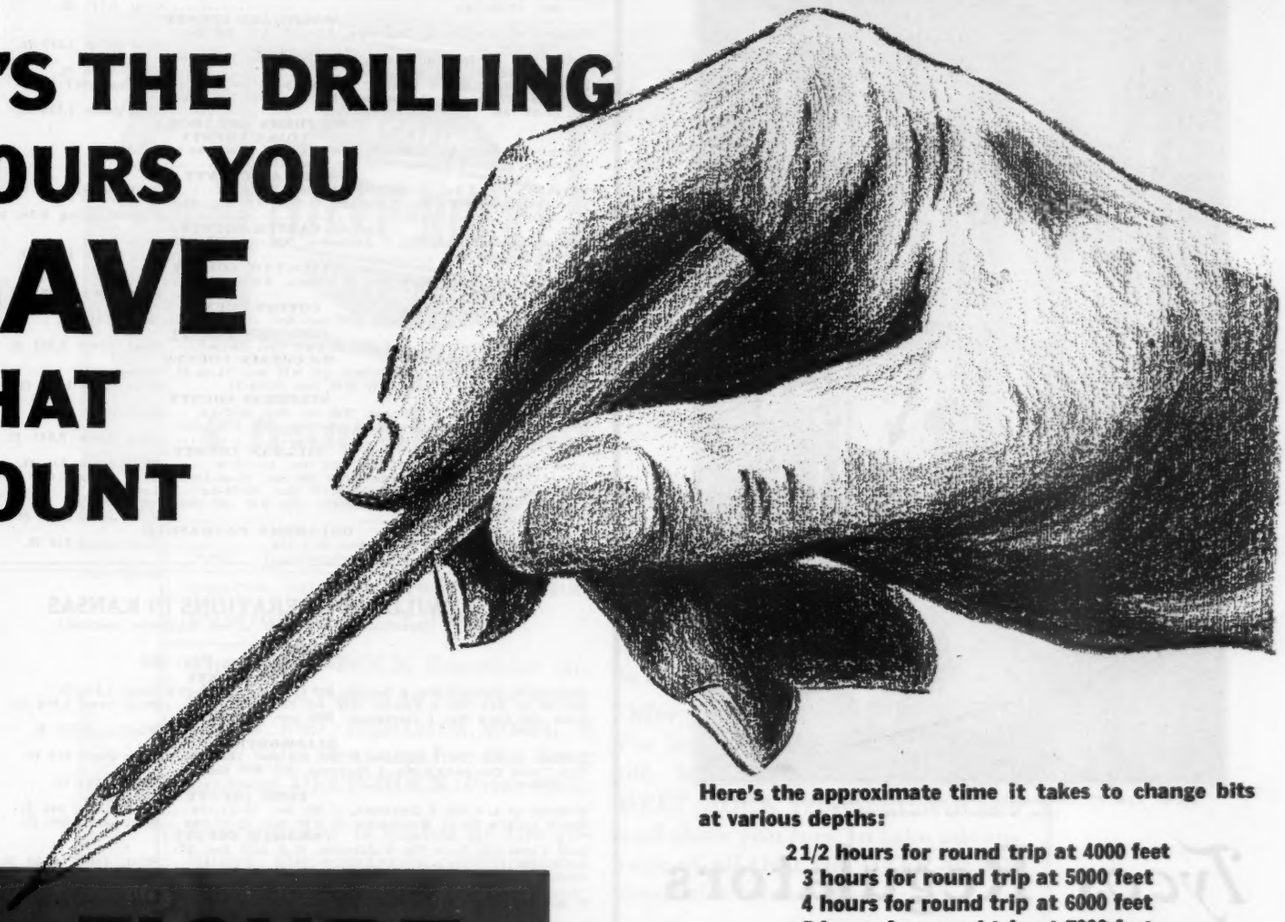

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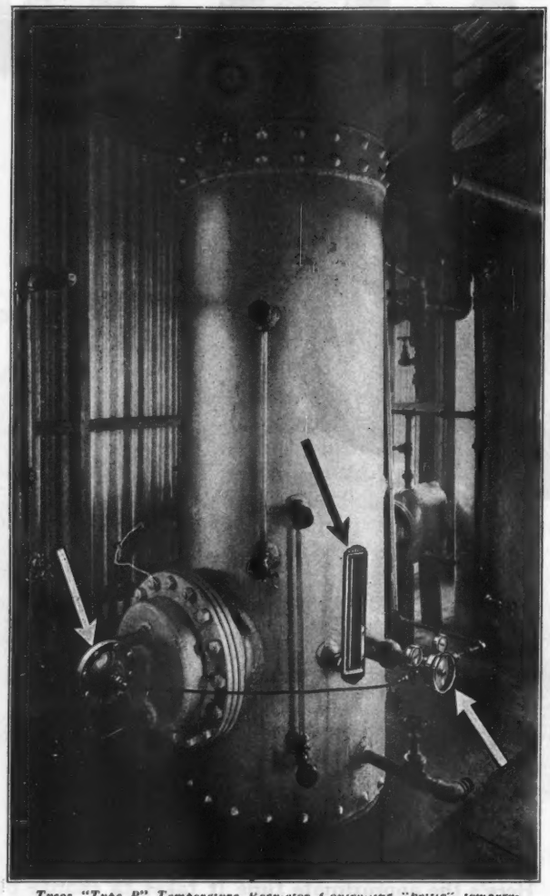

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Buffington and others' No. 1 Melcher, C SW NW Sec. 31-12-24 ..... Shut down 3,000 ft.

WOODS COUNTY

Peerless O. & G. Co.'s No. 1 Unknown, C NW NE Sec. 23-28-16w ..... Cleaning out 1,056 ft.
S. K. Miller's No. 1 Copenhavers, NW cor. NW Sec. 18-24-13w ..... Rigged up and shut down.
Gypsy-Prairie and others' No. 1 Thompson, SE cor. SW Sec. 10-25-15w ..... Drlg. 6,002 ft.
Sinclair Oil & Gas Co.'s No. 1 Showwalter, C SW SW Sec. 33-27-16w ..... Drlg. 5,770 ft.

WOODWARD COUNTY

Farrond et al's No. 1 Unknown, SE cor. SW SE Sec. 2-23-17w ..... Shut down 1,387 ft.
Prairie Oil & Gas and others' No. 1 Wilber, NE cor. NW Sec. 23-23-17w ..... Drlg. 5,830 ft.
Billy's Oil Co.'s No. 1 Watt, C SE Sec. 9-23-20w ..... Fishing 4,967 ft.
Burgoyne Bros.' No. 1 Merkins, SW cor. SE NE Sec. 15-21-19w ..... Shut down 1,910 ft.

SOUTHERN OKLAHOMA

ATOKA COUNTY

Bryant-Croxton's No. 1 Mason, NW NE NW Sec. 4-4s-14. Spudding.
Bookshire's No. 1 Guinn, NW cor. Sec. 18-3s-10 ..... Rig.

BRYAN COUNTY

Marshall's No. 2 fee, C SW SE NW Sec. 26-5s-7 ..... Shut down; 6-in. csg. 265 ft.
Yale Oil Syndicate's No. 1 Craige, C NW NE Sec. 36-9s-9e ..... Underreaming 6-in. csg. 1,890 ft.

CARTER COUNTY

Campen-Lasater Co.'s No. 1 Anderson, NE cor. SE NE SE Sec. 32-4s-2 ..... Shut down 1,500 ft.

CHOCTAW COUNTY

Choctaw Petroleum Co.'s No. 1 Wilson, SW cor. SW Sec. 15-6-19e ..... Shut down 1,346 ft.

COTTON COUNTY

Wirt Franklin's No. 1 Bandy, NW cor. Sec. 4-4s-10w .... Drlg. 3,219 ft.

JOHNSTON COUNTY

Smith & Knisely's No. 1 Lane, E half Sec. 29-1s-7..... Shut down 2,254 ft.

McCURTAIN COUNTY

Utopia Pet. Co.'s No. 1 Unknown, SE NW Sec. 14-9s-25.. Location.
Milton et al's No. 1 Vase, SW NW Sec. 26-6s-21 ..... Shut down 1,490 ft.

STEPHENS COUNTY

Smythe et al's No. 1 Johnson, NE cor. Sec. 30-2-8w .... Shut down 25 ft.
Porter & Monahan's No. 1 Robberson, SE NW Sec. 23-3s-4w ..... Shut down 3,513 ft.

TILLMAN COUNTY

Allen Bros.' No. 1 Howell, SW NE Sec. 13-1-17w ..... Shut down 610 ft.
Staley-Chenault's No. 1 Crane, NE SE Sec. 25-4s-14w .. Shut down 2,000 ft.
Nance et al's No. 1 Massie, NE NW Sec. 36-18-6w .... Location.
Landfair and others' No. 1 Smith, SE SW SE Sec. 6-2s-16w ..... Shut down 2,535 ft.

OKLAHOMA PANHANDLE

Skaer's No. 1 Hitch, NW cor. Sec. 25-1-15e ..... Shut down 250 ft.

WILDCAT OPERATIONS IN KANSAS

(Descriptions are East unless otherwise marked)

(Continued from Page 68)

ELLIS COUNTY

Streeter & Stearns' No. 1 Leiker, SW NE Sec. 26-13-20w. Drlg. 1,290 ft.
Byrene et al's No. 1 Fisher, NW SE Sec. 4-11-20w .... Shut down 1,000 ft.
Rush Oil Co.'s No. 1 Gatewood, NW cor. NW Sec. 4-15-20w ..... Fishing 2,555 ft.

ELLSWORTH COUNTY

Tatlock et al's No. 1 Sackem, C SW SE Sec. 25-17-9w .. Shut down 675 ft.
The Texas Company's No. 1 Sherman, NE SW Sec. 16-17-6w ..... Drlg. 3,790 ft.

FORD COUNTY

McNabb et al's No. 1 Unknown, C SE Sec. 26-27-22w.... Shut down 400 ft.
Swain et al's No. 1 Kenthorne, C NW Sec. 21-25-24w .. Shut down 390 ft.

GRAHAM COUNTY

Gulf Coast Oil Co.'s No. 1 Johnson, C S half Sec. 27-8-25w ..... Shut down 4,232 ft.
Naylor et al's No. 1 St. John, NW SE SE Sec. 27-8-25w.. Rig.

GREENWOOD COUNTY

F. Konkay et al's No. 1 Rock, NW NE NE Sec. 7-27-12 .. Shut down 50 ft.

HARPER COUNTY

Boeler et al's No. 1 Bear, C NE Sec. 21-31-6w ..... Shut down 440 ft.
Tom Slick Oil Co.'s No. 1 Miller, SE cor. Sec. 13-34-8w ..... Shut down 5,400 ft.; Wilcox 5,268-74 ft.; hole full water. T. D. 5,312 ft.; abandoned.
Tom Slick Oil Co.'s No. 1 Thompson, NW cor. Sec. 19-32-6w ..... Wilcox 4,975 ft.; Shut down 5,125 ft.; hole full water.

HARVEY COUNTY

Walton Oil Co.'s No. 1 Neiman, C NE SE Sec. 13-24-2 .. Fishing 3,232 ft.
Superior's No. 1 Regier, SE NW Sec. 11-22-3w ..... Drlg. 1,045 ft.
Independent & Reserve Oil Co.'s No. 1 Moulds, C NE Sec. 7-24-1w ..... Underreaming 6-inch csg. 3,320 ft.
Liggett et al's No. 1 Regier, C SE NW SE Sec. 2-23-3w.. Drlg. 2,907 ft.
E. W. Marland, Inc.'s No. 1 Neiman, C NE SE NE Sec. 8-24-2 ..... Shut down 1,540 ft.
McCulloch et al's No. 1 Prouty, NW cor. SW Sec. 3-23-1w ..... Drlg. 2,857 ft.
Mrs. Gay et al's No. 1 Grove, C NW NE NW Sec. 29-23-1w ..... Shut down 3,295 ft.
Jolly & Ogg's No. 1 Randall, NE cor. NE Sec. 11-24-1w.. Shut down 3,444 ft.
Jolly & Ogg's No. 1 Hupp, SE cor. NE Sec. 22-23-1w .... Shut down 3,220 ft.

HODGEMAN COUNTY

Phillips Pet.'s No. 1 Hausman, NW NE Sec. 30-22-22w.. Drlg. 4,355 ft.

JEFFERSON COUNTY

Wichita Oil Co.'s No. 1 Simpson, NW cor. SW SW Sec. 19-10-17 ..... Rigged up and shut down.

KINGMAN COUNTY

D. P. Fleeger's No. 1 Ashcraft, SE SW NE Sec. 16-28-7w ..... Drlg. 3,650 ft.
White Eagle's No. 1 Lorenz, C NE SW SE Sec. 25-27-5w. Drlg. 3,570 ft.

LANE COUNTY

Robinson's No. 1 Dickerson, Sec. 11-18-27w ..... 8-in. csg. 2,625 ft.
Blankenship Pet. Co.'s No. 1 Schaeffer, NE cor. NE Sec. 24-16-28w ..... Spudded and shut down.

LYON COUNTY

Gordan-Stats' No. 1 Proche, C NE SE NW Sec. 16-17-10.. Shut down 670 ft.
Harry Mortock's No. 1 Dubolt, NW NE Sec. 24-20-1 .... Drlg. 1,860 ft.

MARION COUNTY

Marshall et al's No. 1 Higgins, NE cor. Sec. 33-19-5 .... Rig.
White Eagle's No. 1 Ucker, NE NW Sec. 24-17-2 ..... Drlg. 2,580 ft.

McPHERSON COUNTY

Dixie Oil Co.'s No. 1 Johnson, SW cor. Sec. 20-17-3w .. Rig.
Harry Skelly et al's No. 1 Neufeldt, SE NE Sec. 19-21-3w. Location.
McCulloch Oil Co.'s No. 1 Cornelius, SW cor. Sec. 7-21-4.. Drlg. 2,930 ft.
Kansas Oil Co.'s No. 1 Otto, SW NW Sec. 21-20-1w .... Shut down 2,000 ft.
Reynolds et al's No. 1 Koohn, NE SE NE Sec. 15-20-2w .. Drlg. 2,272 ft.
McPherson O. & G. Co.'s No. 1 Fisk, SW NE NE Sec. 16-21-2w ..... Drlg. 2,972 ft.
McPherson O. & G. Co.'s No. 1 Sorenson, C SE Sec. 23-18-2w ..... Drlg. 2,937 ft.
Milmac's No. 1 Decker, NW cor. Sec. 11-20-3w ..... Fishing 1,500 ft.
Perry et al's No. 1 Wade, C SE Sec. 20-19-4w ..... Drlg. 3,903 ft.
Transcontinental Oil Co.'s No. 1 Algers, NE SW Sec. 1-19-5w ..... Shut down 3,680 ft.

MORTON COUNTY

White & Chaney's No. 1 Love, NE cor. Sec. 16-34-42w... Rig on ground.

MORRIS COUNTY

Arrow O. & G. Co.'s No. 1 Kinkle, C NW NE Sec. 8-16-7.. Shut down 50 ft.

(Continued on next Page)

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The Stearns-Roger Manufacturing Co.

Established 1885

Engineers, Contractors & Manufacturers

CABLE ADDRESS
"STEROG" DENVER

Denver Oct. 26, 1929

IN REPLY
PLEASE REFER TO

Messrs. W. A. TROUT,
C. R. BUTLER, and
C. A. RASMUSSEN,
C/o Mr. FORD W. HARRIS,
471 Chamber of Commerce Bldg.,
Los Angeles, Calif.

Gentlemen:-

Referring to suit which you have filed against this Company for infringement of patents which you hold on casing heads, we have taken up with our attorneys the question of our patent rights and after a thorough investigation have concluded that your position is correct and that your patents are being infringed by us; and we are, therefore, discontinuing the manufacture of all casing heads at an early date.

We appreciate very much your kind attitude in permitting us to discontinue without further action on your part - and, assuring you of our best wishes, we remain

Very truly yours,

THE STEARNS-ROGER MANUFACTURING CO.,

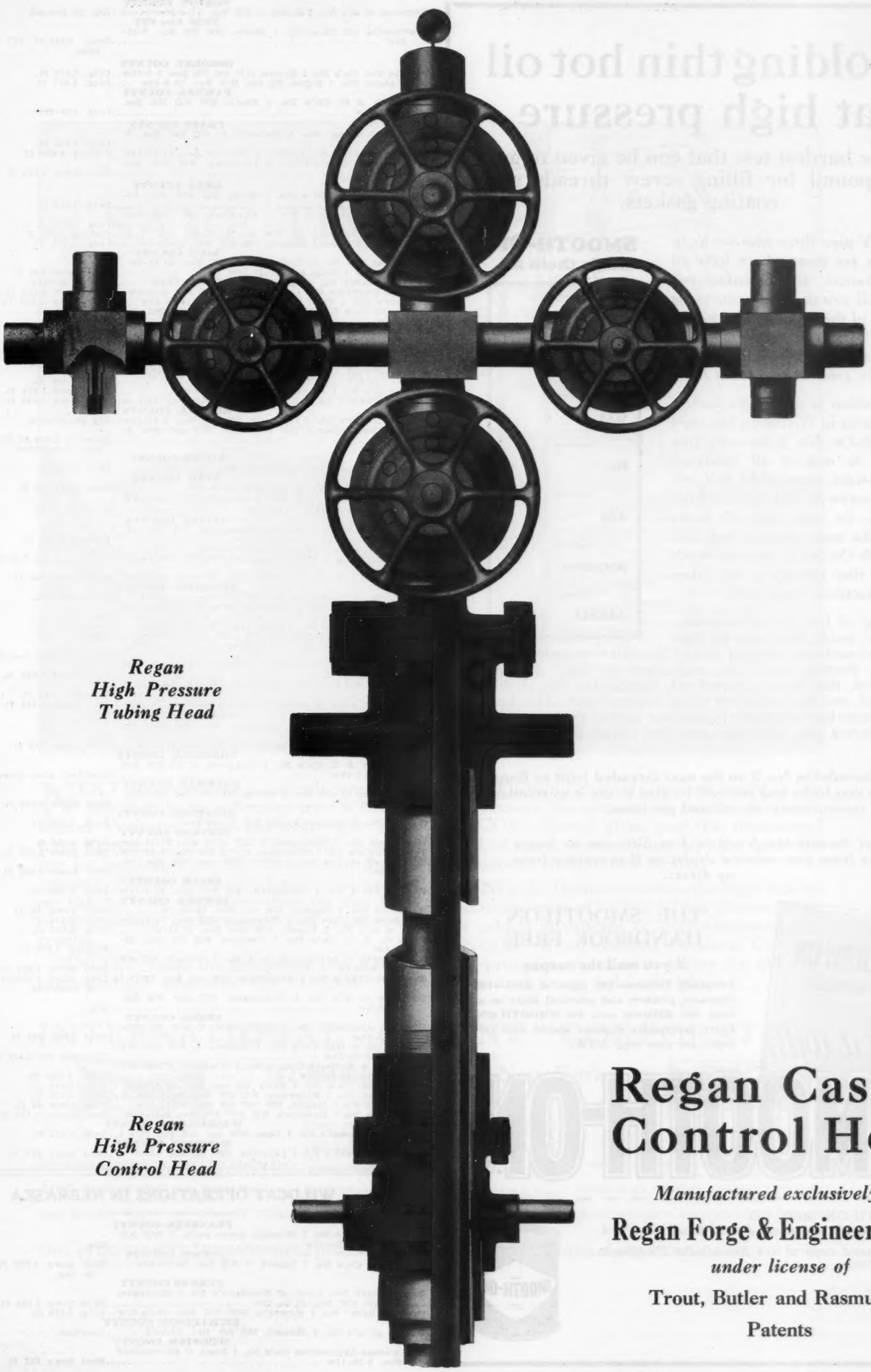
By R. W. Gordon

Vice President.

PATENT SETTLEMENT

Suit was filed against Stearns-Roger Manufacturing Co. of Denver, Colorado, in April, 1929, alleging infringement of our casing head patents 1,566,256, 1,566,257 and 1,572,052. In consideration of our dismissing this suit Stearns-Roger assigned to us all their patent applications on casing heads, discontinued the manufacture of casing heads, allowed an injunction to issue against them and wrote us the letter as reproduced above.

(Signed) *W. A. TROUT,*
C. R. BUTLER,
C. A. RASMUSSEN.



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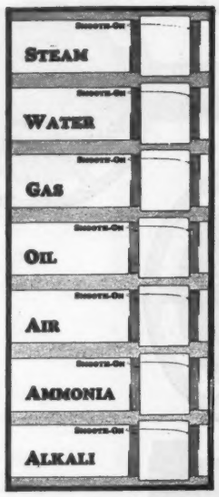
Patents

Holding thin hot oil at high pressure

—the hardest test that can be given to any compound for filling screw threads and coating gaskets.

ANY pipe fitter who works in a gas plant where light oil and benzol are manufactured will tell you that lines conveying either of these fluids must be absolutely tight at the joints—also that it takes something exceptionally good to stop leaks here.

SMOOTH-ON holds them all

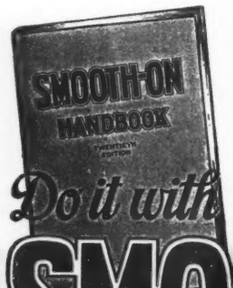


A foreman in one of the largest gas works in Wisconsin has used Smooth-On No. 3 for over five years in making all kinds of steam-tight, water-tight and oil-tight screw-thread joints. Like others, he says that oil leaks give the most trouble, and that Smooth-On No. 3 does the work better than litharge or any other manufactured compound.

In one of his typical instances, an 8 in. saddle flange on the light oil heat exchanger leaked around the entire threaded joint. After shutting down the exchanger, the joint was unscrewed, the threads wiped off, Smooth-On No. 3 was applied, and the repair left to set for one hour. This heat exchanger has since been in constant service for two years, and during that time this joint has remained absolutely tight.

Try Smooth-On No. 3 on the next threaded joint or flange gasket that leaks and you will be glad to use it as standard on all steam, water, air, oil and gas lines.

Get Smooth-On No. 3 in 1 or 5-lb. can or larger keg from your nearest dealer or if necessary from us direct.



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12-5-29

NORTON COUNTY

Richards et al's No. 1 Colby, C SW Sec. 17-4-21w .....Rig on ground.

NESS COUNTY

Continental Oil Co.'s No. 1 Moses, NE SE Sec. 7-18-25w .....Drlg. 4,428-31 ft.; swabbed 135 bbls.

OSBORNE COUNTY

Phillips Pet. Co.'s No. 1 Grieve, NW SE NE Sec. 6-7-12w..Drlg. 3,570 ft.
Mid-Kansas' No. 1 Boyce, SE cor. NW Sec. 18-6-13w ....Drlg. 3,975 ft.

PAWNEE COUNTY

Prairie O. & G. Co.'s No. 1 Black, SW NE NE Sec. 11-20-18w .....Drlg. 625 ft.

PRATT COUNTY

O'Haver & Jones' No. 1 Garacke, C NE SW Sec. 7-26-14w .....Drlg. 1,445 ft.
O'Haver & Jones' No. 1 Lunt, C SW NW Sec. 15-28-14w..Fishing 4,650 ft.
Wilcox O. & G. Co.'s No. 1 Unknown, SW NW Sec. 7-26-15w .....Shut down 1,100 ft.

RENO COUNTY

Empire O. & R. Co.'s No. 1 Blitz, NE NW Sec. 36-25-4w .....Drlg. 3,363 ft.
Wilcox O. & G. Co.'s No. 1 Unknown, SW NW Sec. 22-26-8w .....Drlg. 2,650 ft.
Witt's No. 1 Olsen, C SE NW Sec. 14-22-6w .....Fishing 2,010 ft.
Skelly Oil Co.'s No. 1 Birkett, NE SW Sec. 30-24-7w ....Drlg. 3,975 ft.

RICE COUNTY

Tatlock et al's No. 1 Ploog, C SW SE, Sec. 33-18-9w ..Rig.
Boucher's No. 1 Bieg, Sec. 16-21-10w .....Shut down 630 ft.
C. P. McBride's No. 1 Green, C NW Sec. 33-19-6w .....Rig on ground.
Miller & Detrick's No. 1 Shumway, C SW Sec. 2-20-9w ..Shut down 3,100 ft.
Burgher's No. 1 Fair, C SE NE NE Sec. 14-21-10w ....Shut down 1,200 ft.
Derby Oil Co.'s No. 1 Johnson, C NW NE SE Sec. 24-20-6w .....Drlg. 460 ft.
Milmac's No. 1 Cain, C SE Sec. 29-19-7w .....Drlg. 3,280 ft.
Danciger et al's No. 1 Bell, C SW Sec. 16-19-8w .....Drlg. 680 ft.
McCullough et al's No. 1 Williams, C NE Sec. 35-20-8w..Rig.

RILEY COUNTY

Arkansas Fuel Oil Co.'s No. 1 Martin, SE NE SW Sec. 24-8-4 .....Drlg. 1,900 ft.
Grey et al's No. 1 Smith, NE SE Sec. 30-6-6 .....Shut down 1,970 ft.
Derby & Shaw's No. 1 Lindstrom, NE cor. Sec. 32-7-6e..Shut down 2,246 ft.

RUSSELL COUNTY

Cress & Hacke's No. 1 Unknown, SE cor. Sec. 6-13-12w..Rig on ground.
Midwest Exploration's No. 1 Benson, SW cor. Sec. 4-14-15w .....Show oil 3,064-82 ft.; swabbed 100 bbls. completed.

ROOKS COUNTY

Central Commercial's No. 1 Baxa, Sec. 22-9-17w .....Drlg. 2,834 ft.

RUSH COUNTY

Milmac's No. 1 Mohr, C NW Sec. 11-18-16w .....Shut down 50 ft.
Danciger Oil Ref. Co.'s No. 1 Pivonka, NE cor. SW NE Sec. 17-19-17w .....Drlg. 4,100 ft.

SALINE COUNTY

Dixie Oil Co.'s No. 1 Thorstenburg, NW NE Sec. 10-16-3w .....Fishing 3,602 ft.
Austin et al's No. 1 Olsen, NW SW SE Sec. 10-15-4w ....Drlg. 3,446 ft.
Templeman's No. 1 Lanbengager, C SW Sec. 20-15-5w ..Underreaming 6-inch casing, 3,268 ft.
Twin Mounds' No. 1 Weis, NW NE NW Sec. 20-13-4w..Shut down 700 ft.

SEDGWICK COUNTY

Moore's No. 1 Stewart, C NE SE NW Sec. 18-28-1w ....Drlg. 2,970 ft.
Tavender et al's No. 1 McLean, SE SW SE Sec. 23-26-1w .....Rig.
Wentz Oil Corp.'s No. 1 Allison, NE NW Sec. 24-26-2 ...Drlg. 3,330 ft.
Wilson et al's No. 1 Ottaway, SW NW Sec. 16-28-2w ....Rig.
Marland and Amerada's No. 1 Sensorth, NW cor. Sec. 25-28-4w .....Underreaming 5-inch csg. 3,820 ft.
Barnett O. & G. Co.'s No. 1 Davidson, NW cor. NW SW Sec. 27-26-1e .....Shut down 3,358 ft.
McCullough Oil Co.'s No. 1 Buckles, NW cor. SE Sec. 3-28-1w .....Fishing 1,115 ft.
LaFont et al's No. 1 Carlton, C SE SE SW Sec. 24-28-1e..Shut down 1,385 ft.

SHAWNEE COUNTY

Jenkins & Scott's No. 1 Sherman, NW NE Sec. 28-10-15 .....Rig.
Jenkins & Scott's No. 1 Haden, NE SE Sec. 8-12-14 ....Shut down 750 ft.

SHERIDAN COUNTY

Mandalin O. & G. Co.'s No. 1 Unknown, C SE SW SW Sec. 27-7-26w .....Spudded; shut down.

SHERMAN COUNTY

A. L. Henson et al's No. 1 Murry, NE cor. SE NW Sec. 22-7-40w .....Shut down 3,035 ft.

STAFFORD COUNTY

Gibson's No. 1 Mueller, C SW Sec. 11-23-14w .....Drlg. 1,675 ft.

STEVENS COUNTY

McKenna's No. 1 Unknown, C NW NW Sec. 29-33-36w..Drlg. 1,350 ft.
Trees Oil Co.'s No. 1 Thompson, C NE SW Sec. 2-35-38w..Shut down 2,250 ft.
W. Sidwell et al's No. 1 Kelly, SW cor. NE Sec. 16-34-38w .....Shut down 1,600 ft.

SMITH COUNTY

Phillips Pet.'s No. 1 Clydesdale, SE NW Sec. 23-5-14w..Drlg. 3,400 ft.

SUMNER COUNTY

Hatfield's No. 1 Dauber, NE cor. Sec. 18-30-1w .....Shut down 50 ft.
Kingwood Oil Co.'s No. 1 Stayton, C NE Sec. 18-31-2w..Drlg. 3,110 ft.
Slick et al's No. 1 Peasel, NW cor. Sec. 33-31-1w .....Drlg. 3,178 ft.
Lario O. & G. Co.'s No. 1 Osborne, NE SE Sec. 21-30-1w .....Fishing 3,300 ft.
E. K. Carey & Larado Oil Co.'s No. 1 Welsch, SW SE Sec. 9-34-1e .....Shut down 3,900 ft.
Shell Pet. Corp.'s No. 1 Armstrong, NE cor. Sec. 12-33-1e.Drlg. chat 3,400-57 ft.; show oil in 6-in. csg.
Davidson et al's No. 1 Strickland, SW cor. SE Sec. 12-35-1w .....Rig.

TREGO COUNTY

Dixie & Amerada's No. 1 Reitmayer, C NE NE Sec. 19-14-21w .....Shut down 825 ft.
Prairie Oil & Gas Co.'s No. 1 Kutina, C NE SW NE Sec. 29-15-21w .....Cleaning out 3,340 ft.
Producers & Refiners Corp.'s No. 1 Kingsley, C SE NW NW Sec. 24-14-21w .....Drlg. 2,090 ft.
Phillips Pet. Co.'s No. 1 Spitz, SE cor. Sec. 24-12-25w ..Drlg. 3,430 ft.
Mid-Kansas' No. 1 Ridgeway, NE SW Sec. 28-12-21w ....Drlg. 4,175 ft.
Day et al's No. 1 Gugler, SW NE NE Sec. 36-12-21w ....Shut down 50 ft.
Day et al's No. 1 Unknown, NE NW SW Sec. 2-11-21w ..Shut down 3,250 ft.

WASHINGTON COUNTY

McCool & Vincent's No. 1 Linn, NW cor. NE Sec. 27-4-3..Drlg. 3,075 ft.

WOODSON COUNTY

Shaffer & Howell's No. 1 Levering, CSL SE Sec. 12-25-14..Shut down 650 ft.

WILDCAT OPERATIONS IN NEBRASKA

FRANKLIN COUNTY

U. R. Drlg. Co.'s No. 1 Brunkle (twin well), C NW SW NE Sec. 2-3n-13w .....Rig.

CHASE COUNTY

Chase Pet. Co.'s No. 1 Ingold, C NE Sec. 24-6n-38w ....Shut down 4,200 ft.; will run 5-in. csg.

FURNAS COUNTY

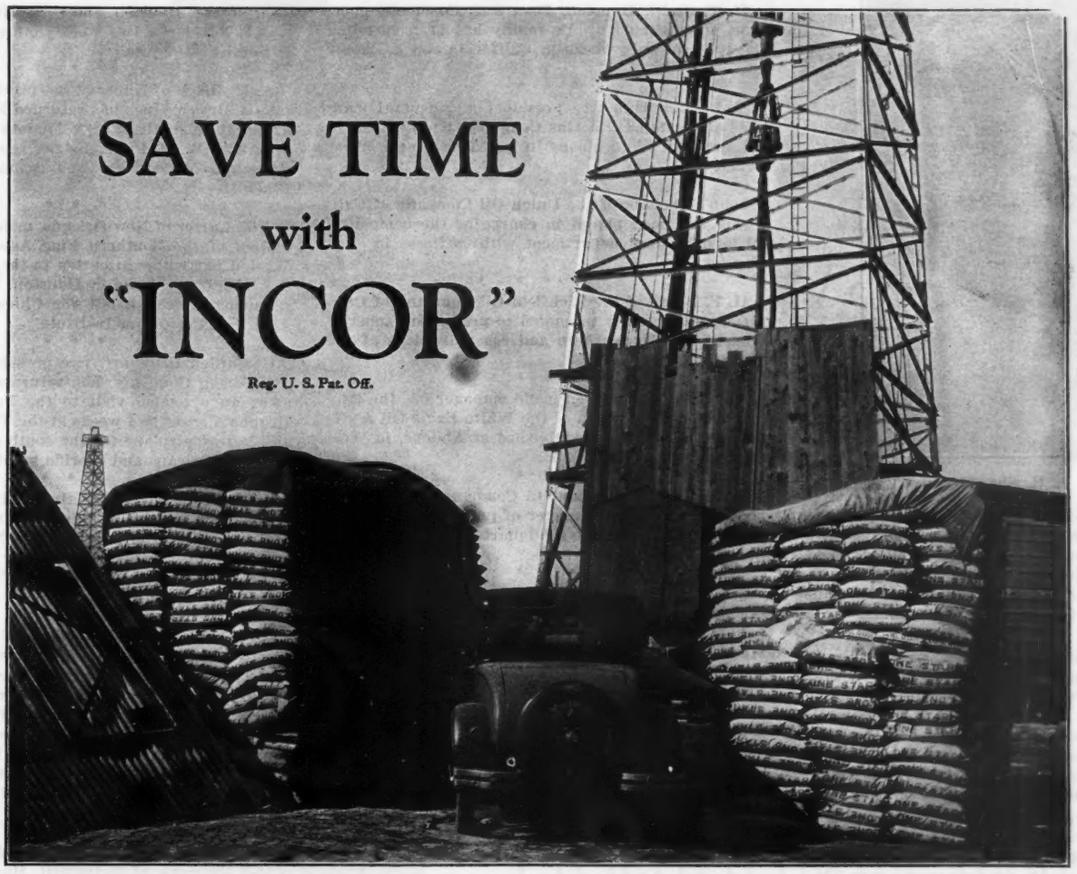
Southwestern Pet. Corp. of Nebraska's No. 1 Montague, SE SW SW Sec. 28-1n-22w .....Shut down 1,750 ft.
Graham Bros.' No. 1 Edwards, NW SW Sec. 13-2n-22w..Drlg. 3,250 ft.

RICHARDSON COUNTY

Norton et al's No. 1 Hauser, NE cor. Sec. 36-1-14 .....Location.

WEBSTER COUNTY

Mid-Kansas Exploration Co.'s No. 1 Platt, C SE one-half Sec. 3-1n-11w .....Shut down 555 ft.



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One of the world's largest cement producers—13 mills... total annual capacity 21,000,000 bbls.

MEN KNOWN IN OILDOM

L. H. Sharp

Exploration and development of new properties is the specialty of L. H. Sharp, assistant field superintendent for the Oklahoma-Kansas division of the Atlantic Oil Production Company. Wildcatting has been his hobby ever since his return to the production fold in 1918 in the service of the Atlantic organization.

Mr. Sharp was born on a farm near Waverly, W. Va., in 1876. Production of crude oil meant nothing to him until after completing a course in the Mountain State Business College he got a job with the Frazier Drilling Company, not as a bookkeeper or stenographer, but as a ditch digger. Four years of service with this company brought him into contact with every sort of lease duty short of pushing tools.

In 1900 Mr. Sharp turned his back on production to try his hand at refining. He took a job with the Webster Oil & Refining Company in Marietta, Ohio, where he remained for the ensuing three years. Then he went with the refining department of the Sunlight Oil & Gas Company in Philadelphia, and remained with that organization for 15 years. Returning to production work with the Atlantic company, he was sent to Oklahoma.

Mr. Sharp is a lover of outdoor life. He is fond of driving, especially when time permits a visit to the Ozark mountains.

He is proud of his three sons, one of whom, Carl F. Sharp, is with the engineering staff of the Atlantic Oil Production Company in Dallas. Another son, J. Lester, is in the insurance business. The youngest is still attending school.

PERSONAL PARAGRAPHS

Dr. Victor Henny, Universal Oil Products Company, Chicago, has left London for Sweden.

* * *

Maj. C. B. Harcourt has been appointed a director of Venezuelan Consolidated Oilfields, Ltd.

* * *

W. S. Farish, president of the Humble Oil & Refining Company, Houston, Tex., has been in New York City on business.

* * *

David Boylan, director of General Paint Corporation, has been calling on trade in West Texas and the Gulf Coast states.

* * *

O. R. Seagraves, president of the United Gas Company, Houston, Tex., has been taking a short vacation at his ranch home near Kerrville, Tex.

* * *

Roy E. Kohn, formerly general manager of the Westcott Valve Company, is now in the oil sales department of Crane Company, calling on natural gas companies.

W. H. Behrens has resigned his seat on the board of Venezuelan Consolidated Oilfields, Ltd., owing to continued ill health.

* * *

R. D. Wallace, of the land department of the Prairie Oil & Gas Company, accompanied by Mrs. Wallace, is spending three weeks in Montana.

* * *

H. T. Staiti, Houston, Tex., Gulf Coast oil operator, accompanied by his family has been spending the past several weeks in California on a motor trip.

* * *

E. B. McFarlin, vice president and general manager of McMan Oil & Gas Company, is on a visit to properties of the company in Southwest and West Texas.

* * *

John S. Schalk of the Union Oil Company of California has been placed in charge of the company's oil land leasing department with offices in Los Angeles.

* * *

H. F. Boggs of the Richfield Oil Company of California was recently promoted to production superintendent for the southern and coast divisions of the company.

* * *

David Wask has been made manager of the land and geological division of the White Eagle Oil & Refining Company just established at Abilene, in West Central Texas.

* * *

E. Power of the Union Oil Company of California has been appointed manager of properties and facilities with offices at the headquarters of the company in Los Angeles.

* * *

Frederick F. Doyle of the Pacific Gas & Electric Company has been appointed manager of the company's natural gas department and will maintain his office at San Francisco.

* * *

Ira E. Lynch, Muskogee, Okla., petroleum accountant in the Muskogee division, United States Geological Survey, is studying accounting methods in the Rocky Mountain region.

* * *

Len Walker, superintendent of the Goleta division of the Pacific Western Oil Company, has returned home from the Seaside Hospital at Long Beach, Calif., following an operation.

* * *

Frederick D. Anderson of Los Angeles, Calif., associated with Ohio Oil Company operations on the Pacific Coast, has been at the Casper, Wyo., offices several days on company business.

* * *

George Johnston, assistant field superintendent of the Lago Petroleum Corporation in Venezuela, after his serious illness in New Orleans, has arrived in London and has resigned his position.

* * *

R. W. Loucks, superintendent for the Carter Oil Company, in the Rocky Mountain states, has returned to his Casper, Wyo., headquarters from Billings, Mont., and his company's wildcat on the Six Shooter anticline.

* * *

Mr. and Mrs. Edwin Zoble have left Casper, for Cody, Wyo., where they will make their future home. Mr. Zoble is associated with The Texas Company, and has recently been transferred from the Casper plant to the new refinery in Cody.

* * *

Sheldon Clark, vice president of the Sinclair Refining Company, Chicago, has accepted the invitation of the various interests in the Stadium Corporation to become its president. The stadium was built to be a Chicago edition of the Madison Square Garden.

* * *

Victor W. Killick, for a number of years statistician of the Independent Petroleum Marketers Association, has been appointed to a new position with the State of California and will be located at Sacramento. Mr. Killick is one of the pioneer oil statisticians on the Pacific Coast.

* * *

Charles Hains Hopkins, director of public relations for the Independent Oil & Gas Company, Tulsa, is in Washington, D. C., representing the State of Oklahoma at the hearing before the Department of Commerce and post office department officials on the new transcontinental air mail route via the southern route.

L. L. Layne, assistant secretary-treasurer of the Layne & Bowler Corporation, who was recently operated upon for appendicitis, has been removed from the hospital to his home in Pasadena. He expects to return to his office in a few days.

* * *

Edgar Pierce, president, Louis Pierce, vice president, and Getty Nickson, sales manager, of the Texas Iron Works, Houston, and C. E. Musselwhite, oil operator, left for a two week's outing and deer hunt in Southwest Texas.

* * *

A. H. Black of Kansas City, president of Black, Sivalls & Bryson, Inc., has returned East after making a trip through the Rocky Mountain region in company with W. H. Price, district representative of the company. Mr. Black was accompanied by Mrs. Black.

* * *

J. F. Carter of New Orleans, manager of trade promotion of the Southern Pine Association, who has devoted particular attention to the use of lumber in the oil industry, was in Houston, Tex., on business, following which he left for Chicago to attend the American Petroleum Institute.

* * *

G. Gorden Urquhart, vice president of the American Fomon Company, has returned to Philadelphia after an extended visit to the Pacific Coast. Mr. Urquhart spent two weeks at the Tulsa headquarters and left by airplane for the south stopping at Houston, New Orleans and Florida points.

* * *

Juan J. Ruiz, an executive of the Nicaragua Oil Corporation which has leased 500,000 acres of potential oil land on the west coast of Nicaragua, recently sailed for Nicaragua on a tour of inspection but will later return to the company's office in Los Angeles.

* * *

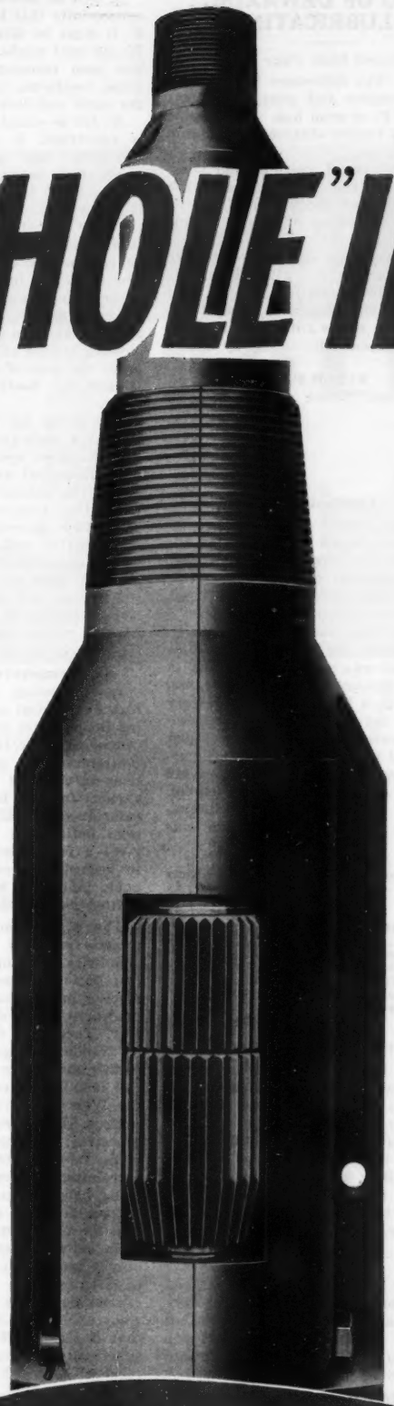
C. W. Ward, superintendent of the Carter Oil Company's gas plant at Salt Creek, Wyo., has accepted a position as assistant superintendent of production for the Royalite Oil Company in the Turner Valley Field near Calgary, Alberta, Canada. The superintendent is Ray O. Armstrong, who until recently was depufy supervisor of the United States Geological Survey at Casper. Mr. Ward has been with the Carter company at Salt Creek for more than six years.

* * *

Directors of the California Oil & Gas Association placed the name of Herbert R. Macmillan at the top of the slate for the annual election of officers December 19. Other nominations were William Reinhardt and C. S. Jones for vice presidents and H. L. Westbrook for treasurer. In addition the following were selected to be voted upon for directors of the Association: R. A. Broomfield; Chester W. Brown, R. E. Collom, J. A. Brown, J. A. Crawford, Earle Derby, W. E. Dunlap, J. Paul Getty, E. B. Gilmore, Paul Grimm, S. A. Guiberson, Jr., Edwin Higgins, L. R. Holmes, J. H. Jenkins, A. T. Jergins, Lester Keim, M. E. Lombardi P. M. Longan, A. B. Macbeth, A. MacDonald, George Machris, Theodore Martin, A. C. Mattei, William C. McDuffie, E. J. Miley, J. R. Pemberton, W. B. Pyron, F. C. Ripley, A. L. Weil.

* * *

M. A. Grisham, M. McAlpine, J. C. Hunter and T. F. Grisham, directors of the Grisham-Hunter Corporation of Abilene, Tex., were hosts to a number of oil men at the company's annual hunt on its private game preserve in McKittrick Canyon and Guadalupe Mountains in Culberson County, Texas. The hunters left Dallas in a special car on November 14 and the hunt continued through November 23. Guests on the trip included: J. Edgar Pew, Sun Oil Company, Dallas; Ralph H. Kinsloe, Magnolia Petroleum Corporation, Dallas; Warner Clark, The California Company, Dallas; H. E. Marsh, Amerada Petroleum Corporation, Fort Worth; John M. Mouser and J. M. Armstrong, The Prairie Oil & Gas Company, Eastland, Tex., William Hudson, Midland Oil Company, Fort Worth; J. E. Fitzpatrick, Deep Rock Oil Co., Fort Worth; R. G. Carr, Texas Pacific Land Trust, San Angelo; Joe Reynolds, Reynolds Cattle Company, Fort Worth; W. C. Spangler, independent producer, Tulsa; L. A. DeLaney, Lowe, DeLaney & Carter, De Leon, Tex., Patrick Hill, Rector Oil Co., Fort Worth; Fred Schoellkopf, The Schoellkopf Company, Dallas; H. H. Wilkinson, vice president Continental National Bank, Fort Worth; Doctor Carter, Eastland, Tex., and F. Jensen, general passenger agent, Texas & Pacific Railroad Company, Dallas.



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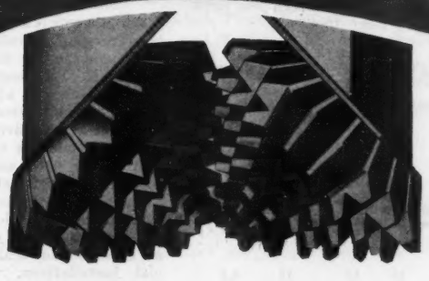

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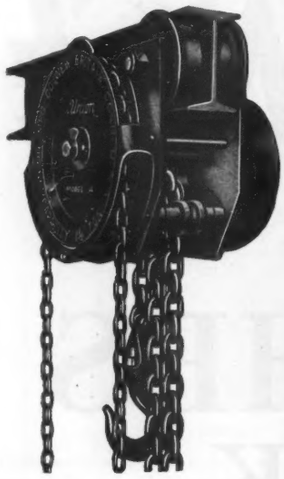

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METHODS OF DEWAXING LUBRICATING OILS

(Continued from Page 115)

for No. 36. The difference between filtering temperature and pourpoint comes to about 28° F. or even less. This result is as good as results obtained by vacuum filtration.

For comparison of vacuum and pressure filtration Run No. 33 was made as a repetition and check of preliminary laboratory work using vacuum filtrations:

Eight gallons of a mixture of 40 per cent 70/75 viscosity at 210° F. sharplessed stock with a cold test of 5° F. and 60 per cent solution naphtha were chilled to —46° F. A single filter leaf was immersed and oil was filtered out by means of vacuum.

TABLE 2

Tests on reduced filtrate were as follows:		
Sample—	1	2
Gravity	24.4	24.6
Flash	440	445
Fire	505	520
Vis./210° F.	84½	86
Pour	—18	—16

Conclusions

The present results check previous results well, in as much as an average difference of 30° F. between filter temperature and pourpoint is found consistently. Smaller differences have occurred, but they are exceptions.

While the experiments were going on it was suspected for a while that some of the smallest wax particles suspended in the oil ran through the filter cake and filter, causing a larger than necessary differential between filtering temperature and pourpoint, particularly under the somewhat uneven action of the pump. For this reason finer grades of filter aid were tried. As can be seen from the following table the suspicion was unfounded and only the rate of filtration was affected.

TABLE 3

Grade of filter aid and rate of filtration:						
Run No.	23	24	27	28	25	26
Filter aid	Hy-flo-Super-Cel		Super-Cel		Fil er Cel	
Pounds per gallon of stock	¼	½	¼	⅜	¼	⅜
Rate of filtration gals./sq.ft./hr.	9.3	14	7.0	7.8	6.7	7.5
Av. temp. difference between filter and pour point °F.	30	30	30	30	30	30

Weir Process vs. Centrifuging

While the rate of filtration is an important economical factor, it is within certain limits, second to another variable introduced by the quantity of naphtha used for dilution. More naphtha means more power used per barrel of finished stock for chilling as well as distilling, to say nothing of increased losses of solvent. It is this factor that the advocators of the Weir process claim makes the filtering more economical than the centrifuging.

Comparing the Weir filtration method with centrifuging or cold settling, they claim that naphtha required for dilution in the Weir process amounts to 45 per cent; for centrifuging 65 per cent; and for cold settling 75 per cent.

In our filtration experiments on semi-plant scale we found it necessary to use about the same amount of dilution naphtha as our commercial Sharples plant is using. When it was tried to cut down the naphtha, an abrupt drop in the rate of filtration was noted. This was the case with treated undewaxed long residuum. Partially dewaxed oil from the Sharples plant naturally could be filtered successfully with much less naphtha. Below are some figures:

TABLE 4
NAPHTHA CONTENT AND RATE OF FILTRATION

Run No.—	32	30	39	40	34
Temp. in chilling drum °F.	—40	—40	—40	—40	+30
Lbs. of Hy-flo-super cel	½	½	1	1	1
Grade of oil:	From Sharples plant		Treated Long residuum		
Pct. naph.ha	75	66	75	66	50
Rate of filtration (gals. sq. ft. hr.)	15	13	15	0.3	..

It will be noted that in order to filter successfully this long residuum at —40° F. it must be diluted with not less than 75 per cent naphtha. The Sharples plant has been running at —25° F. on the same residuum, the same naphtha and the same and lesser degree of dilution.

As far as quantity of dilution naphtha is concerned, it seems to us, the two processes rate about equal. Naphtha losses will occur in either process no matter what type of filter or centrifuge is being used. True, in the Weir process the only loss of account occurs when the filter cake is being blown, and that can be reduced by employing steam or gas. The latter can be recirculated through an absorption system. But even such a process costs money, especially since the wet gas is likely to be rather lean as the blowing is done at very low temperatures; or in the case of steam time and energy is lost by heating and rechilling the filter.

One of the big troubles in centrifuging is that a high gravity naphtha must be used for good operation, to have a gravity differential as large as possible between the solution and the precipitated wax. This creates high naphtha losses. The Weir process does not depend on any gravity differential. Any naphtha within reasonable distillation range can be used. This not only reduces evaporation losses, but also does not tie up a large quantity of as high grade a naphtha, for which there is an ever increasing demand on the market.

Temperature Differential

As previously mentioned a temperature differential of 30° F. between filtering temperature and pourpoint was found consistently for treated long residues. In centrifuging the differential between feed temperature and pour point depends on various factors, but under favorable circumstances a differential of 30° F. or even better can be obtained. Figure 1 gives a comparison of the two methods in regard to working temperature and pour point of 80-90 viscosity at 210 treated long residuum.

The biggest advantage of the Weir process probably lies in its mechanical simplicity as compared with a centrifuge installation. There are no high speed moving parts which, if not carefully attended to, mean danger to life and property. There are few parts that need to be replaced regularly such as filter cloths, and these parts are cheap. Initial installation cost as well as wear of the Weir unit are relatively small.

From this short comparison of the two processes it seems that the Weir process is the better, except for one phase: The petrolatum recovery. The filter cake after being blown, must be extracted and the extract must be reduced in order to obtain the petrolatum, while petrolatum, as it is delivered by the centrifuges needs only a reducing operation to recover the naphtha.

Looking at the two processes from various angles one comes to the conclusion that it seems difficult to determine their superiority in regard to application on residual oils. This of course does not necessarily hold true where existing plant equipment or processes must be taken into consideration. While for one plant with its particular equipment and products the one process may prove advisable, for the next plant the other process may be superior. Some plants as a matter of fact have installed both processes to suit their needs for handling various stocks.

Solvents Other Than Naphtha

All of our work previously outlined has been carried on using the standard solvent naphtha as employed in Sharples dewaxing. The employment of special solvents, such as alcohols, ketones, benzol and chlorinated petroleum ethers, have not as yet advanced to such a stage of development as to be in general use. With large scale employment of special solvents, the price should soon be within a range as to permit economical operation. Much work along these lines is being done by several companies, mostly on an experimental scale. The only commercial installations, within the writer's

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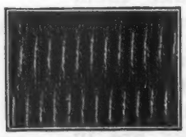

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knowledge, employing other than naphtha as a solvent are in Illinois.

General Economical Conditions

Naturally the economic aspect of producing low pour test lubricant is of vital interest. Just where the happy medium is, between pour test on subzero cold test oils and manufacturing cost, is the subject of much conjecture with the refiners and marketers. From the consumers viewpoint, if the fluidity performance improved in proportion to the lowering of the pourpoint, he can afford to pay a considerable premium for a special oil; this is more so the case in aviation because of the comparatively high maintenance cost and upkeep of aero engines. Against the lowest desirable pourpoint is more or less governed by the extreme atmospheric temperature in which the product is to be used. A fair average for the United States in extreme cold weather conditions has been given as —20° F. An oil with a good fluidity at this temperature, provided it has the other necessary characteristics, should answer all theoretical requirements of an all-weather aero oil. With these qualifications obtained the problem of aero motor lubrication is now nearing its solution.

The inherent flow characteristics of the hydrocarbons present in any given lubricating stock govern, in the final analysis, the lowest temperature at which an oil will flow. Considering a set of samples of lubricating stocks from which all wax has been extracted, ranging from the least viscous, say 50 Saybolt seconds at 210° F., to the most viscous, having 200 Saybolt seconds at 210° F. the pourpoints of these samples plotted against viscosity will describe a straight line. The pourpoints in these cases are determined not by the presence of congealing waxes, but are determined by the congealing at low temperatures of heavy cuts of lubricating stocks. Viscosity, then, is the ultimate limiting factor in the determination of minimum pourpoint.

TABLE 5
Viscosity at 210 vs. Pourpoints of Oils Made from Straight Paraffin Base Mid-Continent Stock and Dewaxed at —40° F. by the Weir Process

Vis. at 210	Pour
48	—18
60½	—12
96	— 8
118	+ 2
139	+ 6
160	+ 8
175	+14
201	+16

Naphthas as Solvents

From the refiner's viewpoint, many and varied complex factors affect the answer to the problem of the optimum low cold test. Second is the question of the use of an economical, efficient and easily recoverable solvent. By far the cheapest solvent in actual cost per gallon is a narrow cut, straightrun naphtha, with about 200° F. initial and 400° F. endpoint. Availability, ease of manufacture with standard equipment, and simplicity of recovery point to the use of naphthas as solvents. The flexibility, as far as initial, endpoint, gravity and distillation is concerned, puts naphtha at the head of the list. Variations in these factors play a large part in the results of the actual dewaxing operation. According to a current article in the June issue of the "Refiner and Natural Gasoline Manufacturer," in which two-stage dewaxing, using the same solvent, is suggested, the use of any solvent other than naphtha is obviously excluded. The final separation of solvent by distillation, comparatively easy using naphtha, becomes more difficult and may entail high losses when constant boiling liquids are used. Chlorinated petroleum products leave an undesirable trace of chlorine in the reduced stock even when used diluted with naphtha. Benzol plus acetone and butanol apparently the only other solvents employed on a large scale today, seem to be working economically.

Third, the lowest economical temperature to which a solution can be chilled, in the opinion of the authors, supplemented by the statements of several refrigerating equipment manufacturers, is —50° F. This temperature, unless future mechanical developments alter the statement, seems to limit definitely the pour test on any given stock. As noted in the aforementioned test run, a constant temperature differential between solution and pour test of 30° F. was noted using naphtha as a solvent. This gives an economical cold test of —20° F.

These temperatures are only obtainable by the use of direct expansion, the use of brine being prohibited by the freezing point of the saturated solutions. Many valuable contributions to this problem of chilling have been made by refrigerating equipment manufacturers in the last two years. The increasing use of direct expansion equipment such as continuous chillers, chilling towers and ribbon chillers, indicates that the minimum temperature requirements below zero will be met in the near future by direct ammonia chilling. Much development work has to be done yet in devising ways and means of better temperature control, especially with reference to chilling rate. Such refinements are bound to come in the near future through the combined efforts of the refiner and refrigerating engineer.

Consumption

Demand plays a natural part in the economical production question. Until such times as the volume of consumption reaches a point where quantity production is in effect, the manufacturer of these extremely low pour test oils can be done only either with a very narrow margin of profits or with no profit at all. In 1926, no man would have predicted the phenomenal growth and development in aviation. In the face of the last three years' development, however, the logical conclusion can be reached, that in not more than three years from date, this economic phase of manufacture will be altered considerably for the better. Educational advertising will play no small part in the expected increase in consumption. The uncanny power of this factor has been well demonstrated.

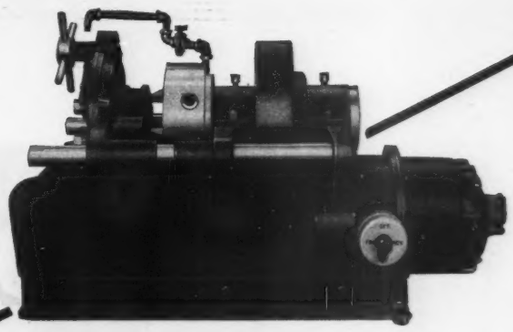
The major element in the cost of production of aero oils has been the power cost for refrigeration. Our figures show that this item stands at the head of the list. Consequently any development tending to decrease the differential between chilling temperature and finished pour test will reflect very favorably on manufacturing cost. The one logical angle to attack this problem seems to be through the solvent employed. As has been demonstrated to the industry, proper preparation of the stock, insuring a minimum of inhibitives present, the type of solvent used, plus the rate of chilling determine this differential. In the opinion of the writers, the answer is 90 per cent of the problem lies in the first two factors.

Lastly, complexity of process and high initial cost are two factors faced by every refiner dewaxing or considering such an installation; installation cost of equipment essential for such an installation is very high, operations are very minute and demand costly supervision and operators. With new and more efficient methods of wax extraction, this condition will, in all probability, adjust itself.

In closing, a glance at the latest development in aero motor power will give rise to room for conjecture from the refiner's viewpoint. Packard has taken the initial step and gone into quantity production in aero Diesel engines. Working characteristics relative to working pressure, speed and temperature are entirely different and much more severe than in a gasoline engine. Whether this new step will materially alter the existing lubricating oil specifications remains to be seen. However, we can rest assured that as the demands become more exacting in the future, they can be met as excellently as they have been in the past, secure in the knowledge that the oil business can supply any product the public is willing to pay for.

GEORGE S. THOMAS DEAD

BRADFORD, Pa., Nov. 30.—George S. Thomas, 62 years, an oil producer in the Duke Center area of the Bradford Field died Friday after a 6 weeks' illness.



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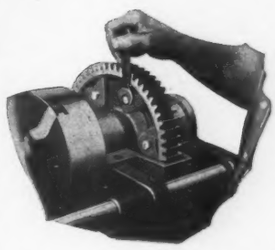

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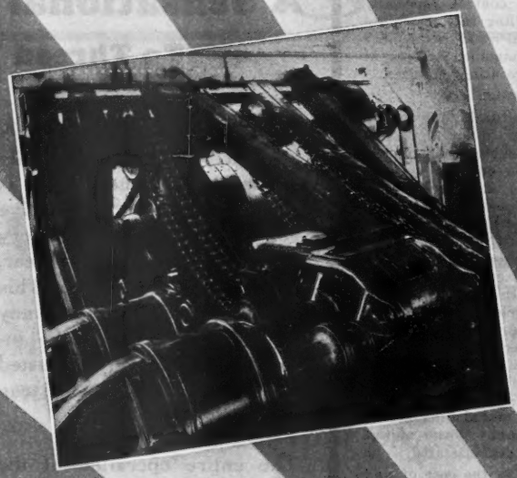

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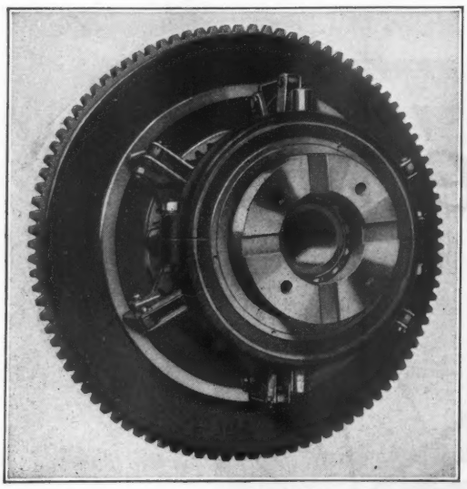

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TWIN DISC CLUTCHES

REPORT OF BUREAU OF STANDARDS SOIL CORROSION INVESTIGATION

K. H. Logan[1]*

The actual work of the Bureau of Standards on the study of soil corrosion and its prevention began in 1922, with one man assigned to the project. In 1929, the Bureau employs five men for this work, and in addition directs the work of three research associates. From time to time it receives also assistance from the United States departments of agriculture and interior, as well as from several technical laboratories of manufacturers and public utilities. The list of organizations that are co-operating in one way or another includes about 125 names.

The soil corrosion work is divided into two general classes: Studies of corrosion phenomena, and studies of methods of preventing corrosion. Necessarily, the two classes are closely related, and some of the problems under investigation might be placed in either class.

The original problem of determining the corrosiveness of soils by burying specimens of pipe at selected locations still receives more attention than any other. At two year intervals specimens are removed from about 70 locations. The results of the examinations of these specimens form the bases for other work, since they furnish data on rates of corrosion and a means of comparing laboratory tests with field results. The most closely related project is the development of methods of determining the corrosiveness of soils. Considerable progress along this line has been made, and several soil characteristics or properties have been identified which we believe are partly responsible for soil action. We realize that among the factors in the problem are the local conditions such as drainage, backfilling of trenches, climate, etc., which are not soil properties and which can only be determined by a study of the locality concerned. We believe that in a few years it will be possible, after the proper examination of a locality, to predict roughly the life of a pipe in that place.

Reducing Corrosion Losses

Of more practical importance is the problem of reducing corrosion losses. During 1929, one of our research associates has devoted a large part of his time to the metallurgical aspects of the problem of determining causes of corrosion and developing a less corrodible pipe.

Two other research associates are working on protective coating problems, one gathering data on the behavior of coatings now in use and the other starting tests on coating applied to short sections of pipe under known conditions. There are certain advantages and disadvantages in each of these methods of studying the problem of pipe line protection.

Closely related to the study of coatings on pipes is the determination of the physical and chemical causes of coating failures and the development of methods of testing coatings. The bureau has assigned a chemist to this problem. He has begun a series of tests to determine how nearly moisture proof a bituminous coating must be to furnish satisfactory protection.

We are also studying the shrinkage of soils on drying, because this is believed to be a factor in the so-called "soil stress" which distorts and destroys certin bituminous coatings in heavy soils.

Soil Conditions

Another project which has received considerable attention during 1929 is the correlation of corrosion on working pipe lines with soil conditions. During the year, studies of one or more lines belonging to five organizations have been made. Some of the results are ready to be reported, while others must be withheld until more data are obtained. It appears that, in addition to stray currents from electric railways and local soil action, two other phenomena sometimes cause corrosion of underground pipe lines. One is the galvanic action resulting when the pipe passes through different soil conditions, or when the line is connected to buried or partially buried structures of different composition; and the other is electrolysis by electric currents, originating either in pump station operation or in geophysical phenomena. The importance of these causes of corrosion has not been determined.

Plans for work during 1930 have not been completed, because much depends on the wishes of those employing research associates.

The bureau will remove and examine about 2,000 specimens of alloys, pipe materials, and protective coatings; and this work will require the major portion of the time of the bureau men during the year. One man will continue the attempt to develop satisfactory methods for estimating soil corrosivity, and another will try to develop a method for determining the effectiveness of bituminous coatings.

The first sets of the specimens buried by the American Gas Association research associate will probably be removed in the fall of 1930, and a report on them prepared for the distribution committee of the association. Forty-two kinds of coatings have been buried, and considerable laboratory work must be done before these coatings can be described with sufficient accuracy to make it possible for a prospective purchaser to so specify the coating he has selected from these tests that he will secure material which will give results similar to those of the test.

It is hoped that the American Petroleum Institute will continue its field studies of coatings, and start some field tests which will throw additional light on what is necessary for a satisfactory pipe coating.

*Before tenth annual meeting American Petroleum Institute, Chicago, Ill., December 5, 1929.

[1]In charge of Bureau Standards soil corrosion investigation, Washington, D. C. Publication approved by Director of U. S. Bureau of Standards (U. S. Dept. of Com.).

OIL PAYS BACK TAXES

LANSING, Mich., Nov. 30.—Each new oil discovery in Michigan is bringing the State from $20,000 to $30,000 in overdue taxes, O. B. Fuller, auditor general of Michigan, estimated after discovery of oil near Clare had netted the State $23,000. The auditor general's office stated that an oil strike will usually result in redemption of from 1 to 3 per cent of the land subject to revert to the State for nonpayment of taxes.

"When an oil field proves to be of some extent and value, all taxes are paid up, as happened in the Muskegon Field," Mr. Fuller said. "So far, most of the oil strikes in Michigan have resulted in a temporary rush to pay taxes, but the great bulk of tax delinquent land has remained unredeemed." The Clare Field, where $23,000 in back taxes was paid in a few weeks, is the latest oil discovery in Michigan. It is located at a considerable distance north of the Mount Pleasant Field.

BIENNIAL REFINING CENSUS

The total value of production of establishments engaged in petroleum refining in 1927 was $2,142,648,503, according to the Biennial Census of Manufactures. There were 354 establishments reporting with 71,234 wage earners and $113,716,705 in wages paid for the year. The value of production in 1925 totaled $2,376,656,556 in 359 establishments. Of the total in 1927, gasoline was the most important in value, with a figure of $1,022,011,786; followed by fuel oil with a figure of $456,959,052.

OIL TO BE CONSIDERED

CHEYENNE, Wyo., Nov. 30.—Governor Frank C. Emerson has been advised by Secretary Wilbur that the question of development of oil lands would be made part of the studies of the commission appointed by President Hoover to consider public domain problems.

As Good as Good Steel can make it

The name "BETHLEHEM" is marked at intervals on every length of Bethlehem Steel Pipe—assurance that Bethlehem Pipe embodies the same high quality found in other Bethlehem Products.

One of the first requirements for making good pipe is good steel. The steel used in the manufacture of Bethlehem Steel Pipe is made under the supervision of skilled metallurgists, especially for this purpose.

The manufacture of Bethlehem Steel Pipe, from the mining of the ore, through the finishing operations, is controlled by one organization. Each step in the conversion of the steel into pipe is carried out under the supervision of men thoroughly experienced in pipe manufacture. The inspections and tests are most critical, so as to make certain that each length of pipe shipped conforms in every way to the Bethlehem standard.

When you purchase Bethlehem Steel Pipe, you are assured of pipe of uniform structure, and of high quality—pipe that will meet all requirements.

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Bethlehem maintains at Los Angeles, Cal., and at Houston, Tex., well-assorted stocks of line pipe, ready for immediate shipment. Both threaded and coupled and plain-end pipe are included in these stocks.

The tong that grips —and never slips

Patented 1258675, March 12, 1918
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New dies are merely slipped into the slot, they automatically snap into place and stay there. No riveting is required, and the dies can be replaced in 30 seconds.

D+B *Simplex* Tubing Tongs

[Drop Forged]

with replaceable dies

THE D+B Simplex Tubing Tong combines convenience with efficiency. They grip positively...the harder the pull, the tighter they hold. The handle and jaws are drop forged steel. The dies are machined from a special high quality alloy steel and heat treated. The replaceable die is locked into place by a hard steel ball, spring operated, which fits into a recess in the back of the die.

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EMSCO STEEL EQUIPPED WELLS ARE SAFE

NECESSITY FOR KEEPING MOTOR TRUCK RECORDS

(Continued from Page 127)

general sized vehicle in his field for the previous month, together with the percentage of loaded capacity carried and the gallons delivered per month. In addition, a last column indicates the cost per gallon delivered, and is obtained by charging each division for each and every machine in the district at a unit rate, based on the prior average of district performance. This total cost, divided by the total gallons delivered, gives us the cost per gallon; and has tended to create quite a spirit of rivalry among the various field managers in an endeavor to place their districts as near the top of the list as possible. This statement reaches the managers about the tenth of the month following, and is issued on this basis rather than waiting for the actual costs, thus eliminating considerable delay.

Identity of Trucks

Equipment Location Records: Consisting of cards indexed first as to the location of the trucks, showing the identity of the machines at a particular point; and, second, by truck number, showing the location of each individual truck. Right here, let me inject a thought which may prove of considerable assistance in the running of a fleet, involving as most of them do, several different makes and sizes of vehicles. The number of the truck itself discloses its actual identity and age by a very simple process. Each truck number is divided into two groups, separated by a hyphen. Starting from the right, the first two figures indicate the make of the machine, e.g., 01 for one make of machine and 02 for another; 03 for still another, and so on. The third number represents the tonnage of the machine as rated by the operating department. The number on the left of the hyphen is the particular equipment number in company service of that particular size and make of truck; and, by use of a reference memorandum showing the year that a certain numbered series of trucks of a certain size and make entered service. the age of any specific truck is readily obtained.

Report on Tires

Tire Record Report: Furnished semi-annually and compiled from the data of tires removed during the period covered. It shows the average cost per mile of the various sizes and makes of the different manufacturers, and acts as a ready guide in the purchase of additional equipment. In passing, it would be of interest to note that on a study recently completed, involving about 10,000 tires removed over a period of six years, it was definitely shown that the secret of long mileage was the application of the proper type of tire to the service to be rendered.

As an illustration confining ourselves to those machines equipped with either solid or air core type of tires most fleets are made up of three general classes of transportation:

1. Short distance, semi-improved delivered service requiring undoubtedly a tire which I would care to class as the "mud-digging" type. Such machinery is necessarily of the light duty type in the 1½ or 2-ton class.

2. This same class of service in the intermediate or light-heavy duty type, delivering over fairly long routes. Trucks in this class of service require the same general type of tire as the previous group; but where these same machines are confined to the delivery of products in the larger metropolitan centers, the tractive type of tire seems best suited.

3. Last, the large heavy duty truck, either on bulk delivery to the trade or on truck and trailer service in railroad competition, again requiring the tractive type of tire.

Needless to say, care in the selection of the right rubber compound should be exercised to properly fit the proper product to the need.

A somewhat similar record of pneumatic tire performance is also kept, and similar uses are made of this report.

Specification Sheets: Giving, in not too elaborate detail, the special points of the machines themselves. They are kept at the parts depots having jurisdiction over that particular machine; so that, for example, if new piston rings are ordered for a truck in the field, a quick reference to the specification sheet indicates the exact size of the ring to be shipped, including any oversizing, if by chance the block had been rebored. This record is of particular interest to the stock clerk.

So much for the operating end, and now for the application of a few records to the maintenance problem:

Service and Repair Shops: Being established in a location as central as possible to the center of machine distribution, they are operated on the theory that constant production shedules, avoiding seasonal peaks, tend to create a maximum efficiency by not causing any variation in personnel.

Overhauling

Shop Overhauling Schedules: Are based on the opinion of the local inspector, backed by a similar opinion from the chief inspector for the district. These schedules are then submitted to centralized control, and the accounting department indicates the total gallon-miles performed between overhauls. The trucks must have performed an average amount of work since the last overhaul before they will be permitted to enter the shop without special dispensation; in that case to be definitely explained by the inspector in charge. This has tended to stabilize this portion of the business. The overhaul schedules, once arrived at, are issued for the personal information of the inspectors and shop foremen, and under no circumstances are allowed to find their way into the hands of the operating field personnel for fear that a manager or chauffeur, knowing that a particular machine is about to be overhauled, will deliberately allow it to run down from a mechanical standpoint.

The shop getting the machine must first make an estimate as to the cost of reconditioning, and is allowed to proceed without any further authority, provided its estimates for doing the work are within a stated allowable tolerance. If in the opinion of the foreman, however, an over-run in the cost will result, the shop is not allowed to proceed further until investigation has been made and the authority of the home office has been obtained to proceed with the work.

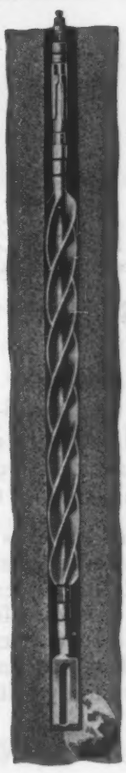
Lubrication Reports

Lubricating Specifications: Covering the use of only specific materials in trucks, and issued for the main seasons of the year, summer and winter. Any location where these recommendations are violated is brought monthly to the attention of the maintenance department, and steps are immediately taken to see that the condition is corrected at once.

Time will not permit a further presentation of many other controls based on reports furnished by the accounting department which are and can be thrown around any fleet of trucks to stop overruns and insure standardization of both maintenance and operation practice; but in closing, I will refer you to a most interesting phase in reference to passenger cars, and that is that many of the economic controls and ideas thrown around a fleet of trucks become more or less nonoperative when it comes to the average handling of a passenger car fleet; and it can be taken for granted that, within the run of the average standard makes of cars, the higher the price of the car, the more it will cost per unit of operation. The normal economic life of motor transportation is ignored, and retirement invariably takes place due to obsolescence or psychological reasons. In passenger cars then, as well as in trucks, the one big thing to be remembered is to keep everlastingly after the maintenance and operation program, keeping the trend always toward the goal of economy and efficiency by use of the principle so well expressed in that old time adage, "A stitch in time saves nine."

The question of elimination of crooked holes is foremost in the minds of operators.

Use spiral stems manufactured by the Titusville Forge Co., and you will eliminate this question once and for all.



The Neber gall Stem

TITUSVILLE FORGE COMPANY
TITUSVILLE, PENN.

28265 Hp. of McIntosh & Seymour Engines in service for the owners of this station

FOUR 6-cylinder 600-hp. units like the one shown and four 8-cylinder 800-b.hp. units have been installed by the same owners during the year 1929—after extensive experience with McIntosh & Seymour Engines through a period of 14 years.

Installations for this company include from one to five units per station and have been service tested and time tried under about every condition that can develop in oil pipe line pumping work. Without exception, these McIntosh & Seymour Engines have made gratifying records for high economy with various grades of fuel, and for year-in year-out dependability in long continuous runs under heavy loads.

McIntosh & Seymour design, strong substantial parts and careful workmanship provide the inbuilt stamina for doing hard continuous work without fatigue and without excessive maintenance expense. The sustained economy of the full-Diesel principle together with the McIntosh & Seymour reputation for rugged construction afford full protection for the investment in McIntosh & Seymour power equipment.

Let us figure on your next station.

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New York City	Kansas City, Mo.	Jacksonville, Fla.	Houston, Tex.	San Francisco
149 Broadway	1016 Baltimore Ave.	412 Bisbee Bldg.	2703 Esperson Bldg.	514 Matson Bldg.

McINTOSH & SEYMOUR DIESEL ENGINES

CORROSION PROBLEMS WITH PRESSURE STILLS

(Continued from Page 94)

As will be noted from the table, the corrosion in various parts of the equipment was reduced by from 80 per cent to 97 per cent. Similar results have been obtained in Cross and Dubbs cracking units, although in some cases the protection has not been as complete as here indicated.

Table 1—EFFECT OF ADDITION OF LIME, 1 LB. HYDRATE PER 100 GALLONS FEED

	Corrosion rates—In. per year		
	Before lime	After lime	Protection per cent
Stills—vapor space	0.192	0.0217	89
Stills—liquid space	0.146	0.0073	95
Preheater outlet	0.131	0.003	97
Bubble tower bottom	0.141	0.028	80

The quantity of sulphur in the charging stock which will produce hydrogen sulphide determines the amount of lime required for efficient protection. In Figure 3 is shown the corrosion rate in the vapor space of "D" still of a Holmes-Manley unit during a period in which the sulphur content of the charging stock was increased from 0.25 per cent to 0.5 per cent. The initially high corrosion rate as indicated in the vapor space of the stills was decreased from 0.192 inch per year to 0.0217 inch, per year, as indicated

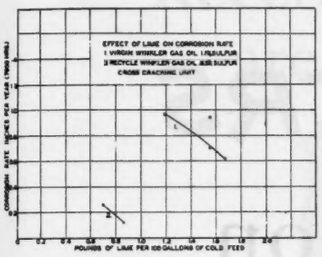
EFFECT OF LIME ON CORROSION RATE
1 VIRGIN WINKLER GAS OIL 1%SULFUR
3 RECYCLE WINKLER GAS OIL 0.93% SULFUR
CROSS CRACKING UNIT
CORROSION RATE INCHES PER YEAR (THOUSANDTHS)
POUNDS OF LIME PER 100 GALLONS OF COLD FEED

Figure 4.

in Table 1. As the sulphur increased, the corrosion rate went up until a rate of 0.071 inch per year was reached. Upon doubling the lime feed, the corrosion rate was again reduced to a low value.

The reduction in corrosion caused by lime is paralleled by the lowered content of hydrogen sulphide in the gas from the stills. Thus before lime was used, the dry gas contained 150 grains hydrogen sulphide per 100 cubic feet. Immediately after lime was started, this dropped to 20 grains, gradually increasing to 50-75 grains as the sulphur went up in the charge, and dropping back to 20 grains when the lime feed was doubled.

Measure of Corrosiveness

The corrosiveness of a charging stock is not measured alone by its sulphur content. Figure 4 gives data from the Pure Oil Co. showing the effect of various quantities of lime on the corrosiveness of two stocks, one a virgin stock containing 1.1 per cent of total sulphur, the other a cycle stock containing 0.93 per cent of sulphur. In the case of the virgin stock, 1.7 pound of lime per 100 gallons of feed gave a corrosion rate of 0.62 inch per year, while for the recycle stock 0.75 pound of lime per 100 gallons of feed gave a corrosion rate of 0.016 with only slightly less sulphur in the stock.

These data indicate the necessity of plant scale experiments to determine the optimum quantity of lime to use. There are some data to indicate that the corrosiveness of a mixture of stocks may actually be less than the average calculated from the corrosiveness of the individual stocks. This fact suggests the possibility of decreasing corrosion by the proper selection of virgin and cycle charging stocks.

Reports from various companies which have used lime show that concentrations from 0.1 to as high as 10 pounds per barrel have been employed on a plant scale. In general, however, the average amount used is in the neighborhood of 1 to 2 pounds of hydrate per 100 gallons of cold feed.

The ultimate disposition of the lime fed to a Holmes-Manley unit is about one-third in the coke and two-thirds in the tar. Evidently the presence of so much lime in the tar may make it unsaleable for certain purposes, thus introducing the problem of removing it by filtration or other means. In some cases, this problem has been regarded as sufficiently serious to preclude the use of lime entirely, although several refineries have achieved a successful solution.

Caustic soda instead of lime may have some advantages, but appears to cause the formation of a very dense coke difficult to remove and introduce the hazard of caustic embrittlement of the steel. Ammonia does not reduce hydrogen sulphide corrosion of this type. A point of superiority in the use of lime over that of resistant alloys is that lime protects the entire system by reducing hydrogen sulphide. When resistant metals are used, only that part of the equipment in which the alloys are employed is protected, and the corrosion is even somewhat intensified in other parts of the system. In this connection, it should be pointed out that when the overhead stock may crack further in another part of the system out of contact with lime, such as in the base of a Holmes-Manley bubble tower, the protection is not so complete at these points. In such cases, resistant liners are being used.

Resistant Metals

A second means of reducing corrosion in pressure still equipment is the use of resistant metals. The chromium-iron and chromium-nickel-iron alloys appear to offer the most promise for this type of service. Because of their high cost in comparison to steel, the use of such alloys is justified only where the safe life of the part under consideration is short. The physical properties of these alloys are often a determining factor in their use.

From the standpoint of complete resistance to corrosion in pressure stills and excellent physical properties, alloys of the class of 18 per cent chromium—8 per cent nickel are best. However, they cost approximately 10 times as much as ordinary steel; consequently only in extremely corrosive conditions is their use justified. Because of their superior physical properties at elevated temperatures, they may often be economically used for the hottest tubes in the preheater, where both heat resistance and corrosion resistance are necessary. In this service, however, some difficulty has been encountered through the use of steel header boxes due to the difference in coefficient of expansion which causes the tubes to become loose in the headers and to leak when the unit is brought up. If alloy header boxes should be required, the expense of alloy tubes would be about doubled. Recent experience along this line indicates, however, that alloy boxes may be unnecessary. At present the 18-8 chrome nickel alloy is regarded as the only proven material for tubes under pressure with extreme temperature and corrosive conditions.

The 16 per cent to 18 per cent chromium iron alloy without nickel, while quite resistant to corrosion, embrittles seriously when exposed to prolonged heating above 800° F. This fact was not discovered until several tube installations had been made, although fortunately the tubes were removed before any serious accidents occurred. At present, the 16-18 chrome is considered quite unsatisfactory as tube material, although for valve trim, liners not requiring strength and such uses, it may be successfully employed. The 12-14 per cent chrome alloy is somewhat less resistant, but is claimed to be free from embrittlement. It finds extensive use as valve trim.

Comparative Resistance

Perhaps of greatest potential importance from an economic standpoint is the 4-6 per cent chromium alloy. This metal, although costing only twice as much as

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Have you seen the Gas Refrigerator?

CLEAN-CUT and modern as a Lindbergh plane . . . these smokeless Texas cities. El Paso recently joined the ranks, piping natural gas 300 miles from a field in New Mexico.

New industries . . . New people . . . New gas. Since the first Lone Star line in Texas 20 years ago we have piped natural gas to 250 cities and towns.

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There is no need to install an entirely new machine!

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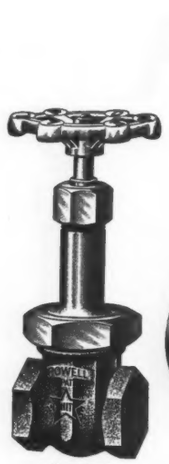

Fig. 375
"White Star" Gate
Valve

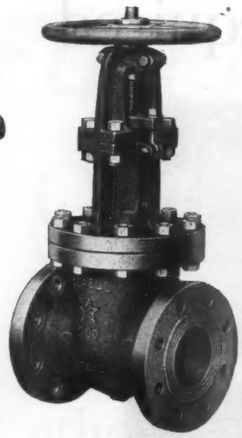

Fig. 3003
Cast Steel Gate Valve

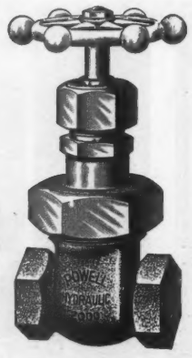

Fig. 178
Hydraulic Gate
Valve

SUCH features as sturdy design, best grade materials, and high safety factors in testing insure added strength of installation.

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POWELL PRODUCTS

A complete line of bronze, iron and steel globe, angle, check, gate and safety valves. Also Oilers, Lubricators, Grease Cups, Water and Oil Gauges, and sundry engineering products particularly adapted for oil well, field and refinery service.

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steel, has from four to ten times the corrosion resistance in pressure stills. The physical properties of the low chrome alloy are reported to be nearly the same as for mild steel, and the resistance to scaling to be slightly better than for steel. The following table gives corrosion rates on the 4-6 per cent chromium alloy compared to steel.

	Corrosion Rate—In. Per Year		
	Holmes-Manley "D" Still vapor space	Bottom of Holmes-Manley bubble tower	Outlet tube of Cross furnace (Pure Oil)
4-6 per cent chromium alloy	0.0014	0.0018	0.027
Still bottom steel	0.0098	0.0165	0.127

The use of metal coatings has been the subject of extended research during the past several years. Calorized tubes were at one time thought to offer great promise for corrosion resistance in pressure stills because of the well-known resistance of aluminum to corrosion by hydrogen sulphide. This product became discredited, however, when experience showed that pitting occurred at many points inside the tubes where the calorizing was imperfect. Some instances have been reported recently where calorized tubes are giving reasonable satisfaction.

A recent survey of the experience of a number of refineries by the Institute's corrosion committee indicates that chromium plating has given rather disappointing results. Chromium itself is quite free from attack, but the operation of plating steel with chromium so that no pinholes are left has not been perfected. For small parts such as thermocouple wells success has been reported, but for tubes and other large equipment chromium plate must still be considered as in the experimental stage.

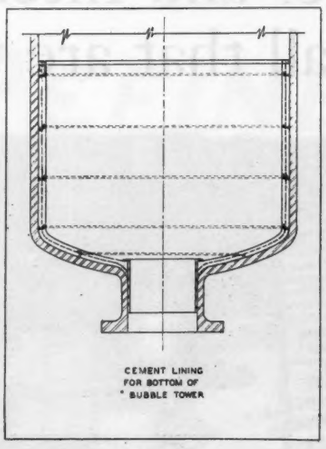

Figure 5.

Linings for Unfired Parts

More recently the use of cement and refractory linings for unfired parts of pressure still equipment has come to the fore. For large vessels this type of protective coating is an economical and satisfactory method of eliminating corrosion, although care in installation is very necessary. Among the types of linings which have been successfully used are portland cement, adamant, thermolith, and others. Most of these require reinforcing.

In Figure 5 is shown a method of installing a cement lining in the bottom of a bubble tower. The walls are carefully cleaned by sandblasting, reinforcing wire installed as shown, and the cement applied by spraying. A fairly dry mixture of equal parts of sand and cement is used. After a preliminary set, the lining is cured with steam for 48 hours, after which it is carefully dried before the tower is returned to service. Linings of refractory cements, in general, require curing at higher temperatures.

Metal lines have been tried, but usually have not been successful because of collapsing by coke accumulations between the liner and metal walls. Equalizer lines on Holmes-Manley stills have been successfully lined with a 14 per cent chrome alloy sleeve.

Proceeds Uniformly

It is general experience that corrosion in pressure still tubes proceeds uniformly and without marked pitting. Near the ends of the tubes, the corrosion is somewhat more severe than in the middle, presumably due to turbulence created at the entrance and exit. The magnitude of these end effects probably varies with the operating conditions, but for units such as Holmes-Manleys the end corrosion does not exceed the average by more than 50 per cent. One instance has been reported where the use of smooth flow return bends decreased this end effect markedly, and hence increased the operating life of the tube.

Unfortunately pressure still corrosion is not always uniform. Severe corrosion of vapor lines on the outside of bends and where they enter or leave stills and towers creates a condition of uncertainty necessitating constant watchfulness. Turbulence effects where safety valve or other connections come into lines cause irregular corrosion also. On a Holmes-Manley unit the backtrap lines are particularly subject to irregular corrosion. Probably these cases can all be attributed to turbulence effects and the corresponding removal or prevention of coatings of coke or corrosion product, although the results are sometimes difficult to explain in a quantitative manner.

It is quite important that frequent tests and inspections for corrosion be made. The Institute's corrosion committee has been studying various methods for conducting tests, and expects to adopt and publish a standard method of testing and reporting results in the near future. This subject is discussed in the current report of the committee.

In Conclusion

In conclusion, it appears that the most promising protective measures for pressure still corrosion are the use of lime, liners of cement, refractories, or metal, and the use of resistant alloys such as 18 per cent chrome-8 per cent nickel for parts of equipment having unduly short life. The 4-6 per cent chrome alloy, because of its relatively low cost and good resistant qualities, gives promise of wide usefulness for all types of equipment.

Adequate protective measures for pressure still equipment are still in an early stage of development, and must advance rapidly to keep pace with the present tendencies towards increased operating temperatures and the influx of sour crudes. Progress along this line can be best effected by co-operative efforts such as are being fostered by the General Committee on Corrosion of the American Petroleum Institute.

KENTUCKY-TENNESSEE

(Continued from Page 94)

northwest of Barnett's Church Pool, is estimated at 75 bbls. initial from the Stray sand formation.

Near Taffy, the Southern Oil Producing Co.'s No. 1 on the Cody Hoover farm, produced 60 bbls. initial from 522-562 feet, there being 40 feet of sand found, opening up an extension to the Stray sand pool in the Taffy area.

In the Friendship Church area, Swarthout, Rhodes and others found a nice gas producer on the C. D. Evans farm. Dr. Sirman also found an excellent gas well on the Cobb heirs' farm, near Fordsville, estimated 1,000,000 feet at around 1,000 feet.

Among the recent dry holes found in Ohio County are: D. J. White and others' No. 4 Earnest Bickett, 90 acres in the Deanfield area; W. J. Flesher and others' No. 1 E. Ralph farm, same field, at 950 feet; James C. Ellis' No. 1 J. H. Evans farm of 78 acres; Fred Weir and others' No. 2 Fred Muffett farm; Chester Oil Co.'s No. 1 Westerfield, at 785 feet; same company's No. 8 Martha Medcalf; S. H. Russell & Co.'s

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No. 4 Walter Midkiff, 88 acres, and No. 11 H. C. Greer farm; S. R. Nigh and and others' Nos. 13 and 14 A. P. Kelley 340 acres, all in the dry list in the Deanfield area. Armstead Oil Co.'s No. 2 on the Arnold Newton 38 acres, is also a duster at 380 feet.

Daviess County Wells

In the Utica Pool, Daviess County, the Creek Drilling Co.'s No. 1 on the Floyd Kirk farm, is reported good for 15 bbls. Evans & Garrison's No. 6 on the Davis heirs 109 acres, same pool, is 100 bbls. initial.

Petroleum Exploration Co.'s second test on the Steven Johnson farm, near Panther Creek in the Red Hill district, is a 35-bbl. pumper, and the same company's second test on the J. H. Gray farm, is a 30-bbl. producer.

Mecca Oil Co.'s test on the J. H. Fuqua farm, near Grandview School, north of the Jones Pool, is a 35-bbl. well at 776 feet and extends the pool a mile or so to the north.

Scattered Completions

Henderson County is looming up like a regular oil field these days, and some mighty fine shallow wells are being found. The Southern Oil Producing Co.'s No. 1 on the Scott heirs farm, in the Niagara Pool, is credited with a production of 60 bbls. from 633-33 feet, and the same company's No. 2 on the Ed Farley farm, a mile north of the Niagara Pool near Coraville, is reported better than 100 bbls. initial at from 670-700 feet.

In Hancock County, Kelley and others' test on the Yewell lease, near Victoria and on a lease block of 2,000 acres, reported good for 500,000 feet of gas.

In the Bowling Green Field of Warren County, P. H. Lavelle's No. 7 on the Lydia E. Patton farm, southwest of the Green, produced 29 bbls. initial from 1,058 feet.

In the Greenville Field of Muhlenberg County, the Missouri-Kansas Pipe Line Co.'s No. 2 on the John Corley farm, has all the earmarks of a big oil producer estimated at better than 200 bbls. from the McCloskey sand, or the Mississippian formation. This company will lay a line from its well to the 3-mile pipe line that takes the Ohio Oil Co.'s oil from its producing wells in the field to the 3,000 storage tank along the railroad at Luzerne. The Ohio Oil Co.'s No. 1 on the R. L. Kennedy 87 acres that was thought to be a good well, has according to advice been abandoned. Same company's No. 1 on the A. F. and C. W. Walker farm, is also listed as a dry hole. E. M. Treat Co.'s No. 1 Jim Bandy farm, adjoining the Brashere gusher, is also in the dry list as is the Missouri-Kansas Pipe Line Co.'s No. 1 on the Volney Fortney farm, east of Greenville. Considerable activity in the transferring of leases has been taking place recently, Ellis and Young having acquired considerable additional acreage in the Greenville Field.

SOME PHENOMENA OF GUM DETERMINATIONS

(Continued from Page 136)

to read the volume. To that end the volume was always read when the temperature of the bath was on the way down

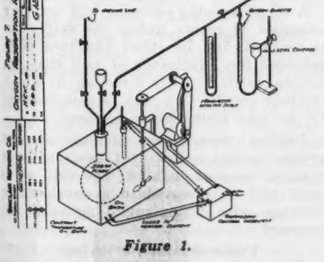


Figure 1.

and had arrived at 212° F. The reason for this was that the temperature came down much slower than it went up.

The apparatus was charged with oxygen and sample in the following manner:

TABLE 5—VISIBLE BOWL TEST OF STRAIGHTRUN GASOLINE FOUR DAYS EXPOSURE

Sample—	138-1A	138-2A	138-2C	138-3B	139-A
Tests before visible bowl:					
Color	30+	28+	30+	30+	27+
Copper dish gum	3.8 mg.	3.8 mg.	3.7 mg.	3.7 mg.	3.9 mg.
Steam oven gum	0.0	0.0	0.0	0.0	0.0
Oxygen abs. gum	10.0	7.0	5.0	8.0	4.0
Tests after visible bowl:					
Color	30+	30+	30+	30+	30+
Copper dish gum	6.4 mg.	7.4 mg.	56.2 mg.	8.0 mg.	8.6 mg.
Steam oven gum	4.4	6.6	3.4	4.6	5.2
Oxygen abs. gum	22.0	25.6	15.7	10.8	18.0
Gum deposit	None	None	Gum	Trace gum	Gum

Note—Gums reported in milligrams per 100 cc.

The system was completely filled with oxygen and evacuated six times to 26 inches of mercury. On the seventh time it was evacuated to 20 inches and the sample (5 cc.) of stock to undergo test was charged. In a few minutes pressure equilibrium was established by means of level control on the oxygen burette, and sufficient oxygen admitted to fill the burette three-fourths full.

All runs were made at atmospheric pressure to avoid the difficulties usually encountered with pressure or high vacuum.

TABLE 6—VISIBLE BOWL TEST OF LIQUID PHASE GASOLINE, FOUR WEEKS EXPOSURE

Sample No.	1	2
Tests before visible bowl:		
Color	30+	30+
Copper dish gum	101.9 mg.	3.0 mg.
Steam oven gum	0.2	0.3
Oxygen abs. gum	6.0	6.0
Tests after visible bowl:		
Color	28+	30+
Copper dish gum	1015.6 mg.	1189.8 mg.
Steam oven gum	279.2	443.4
Oxygen abs. gum	818.8	684.0
Gum deposit	None	None

Note—Gums reported in milligrams per 100 cc.

Dry oxygen for this work was prepared by passing commercial oxygen first through a wash bottle containing concentrated sulphuric acid and then through a calcium chloride drying tube. The wet oxygen was prepared by first drying in the above manner and then humidifying by passage through a wash bottle containing distilled water. No quantitative determinations of moisture content were made.

Tests on the stocks used in this work are shown in Table 7.

TABLE 7—TESTS ON GASOLINE USED IN OXYGEN ABSORPTION APPARATUS

	Straight-run	Liquid phase	Vapor phase
Color	30+	22	+26
Copper dish gum	1.2	8.3	553.0
Steam oven gum	0.0	8.0	4.4
Oxygen abs. gum	9.2	40.4	758.8

Note—Gums reported in milligrams per 100 cc.

In the first tests which were made on straightrun gasoline and on liquid phase cracked gasoline, and in which rubber stoppers were used to seal off the absorption bulb from the surrounding atmosphere (see Figure 2 and 3), there was a marked tendency for oxygen absorption rates to be almost identical regardless of the grade of gasoline used. This was unexpected, since it is common knowledge that, in general, cracked gasolines are more unstable to oxidation effects than are straightrun products.

Investigation disclosed that the substitution of cork stoppers for rubber ones, sealing in cork stoppers with water glass, changed absorption curve characteristics to a considerable degree, and clearly brought out the difference in oxidation resistance of saturated and unsaturated gasolines.

The batch of rubber stoppers used in this test work for all but the wet oxygen vapor phase cracked gasoline digestion became exhausted, and a rubber stopper from a new batch was necessarily used for the wet oxygen vapor phase cracked gasoline digestion (see Figure 4). Difference in composition of rubber was given as the reason for wet oxygen showing less acceleration as compared to dry oxygen in the case of a rubber stoppered vapor phase cracked gasoline digestion. It was noted in instances of regular oxygen absorption gum tests, that, when using rubber stoppers from certain batches, the rubber tended to disintegrate. Such results are not included in data of this paper. The first batch of rubber stoppers used in obtaining data of oxygen absorption curves did not show disintegration, but did increase in size with use. The rubber stopper used for the wet oxygen vapor phase cracked gasoline digestion did not show as much distortion.

The oxygen absorption test work supplying data for Figures 2, 10 and 11 brings out the following points:

1. The use of equipment which is entirely inert to possible physical and chemical effects is important.
2. The presence of moisture accelerates

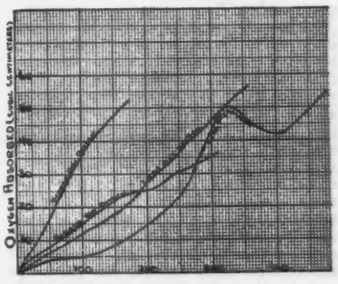
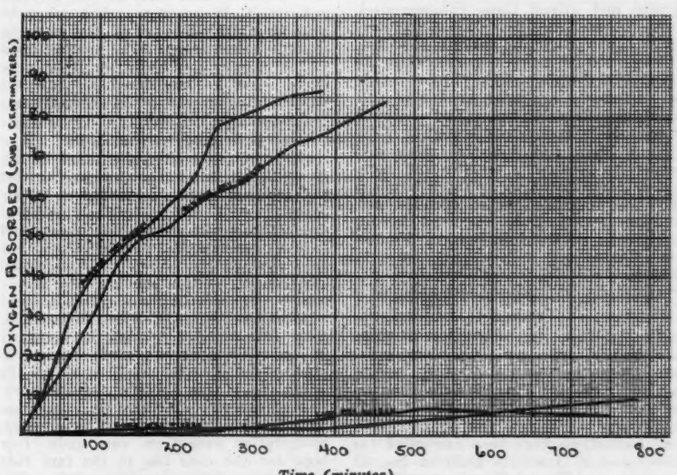


Figure 4—Oxygen absorption rate, vapor phase cracked gasoline, treated.

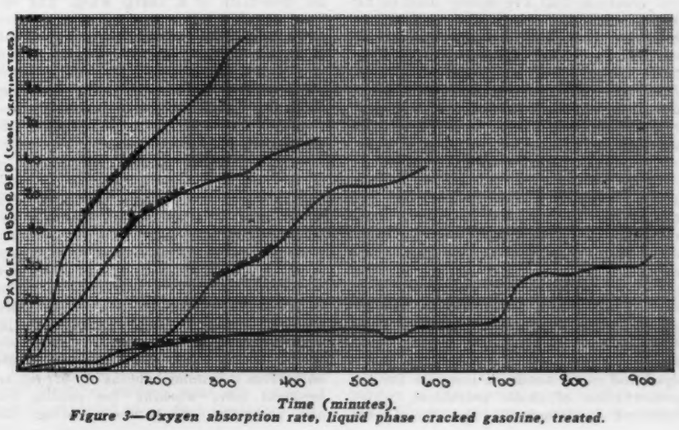
oxidation. The use of dry oxygen or oxygen with controlled moisture concentration is essential for uniform results.

Further study of these points, as well as of air contamination, is contemplated.

The work discussed in the paper is not complete or conclusive. It indicates, however, that the gum determinations by copper dish method, steam oven method, and oxygen absorption method as practiced, cannot be correlated with each other or with storage performance where acceleration of gum formation by light or by metal catalysis is possible. Furthermore there may be other accelerators such as moisture, which influences prediction of commercial performance by laboratory test.



Time (minutes).
Figure 2—Oxygen absorption rate, straightrun gasoline, treated.



Time (minutes).
Figure 3—Oxygen absorption rate, liquid phase cracked gasoline, treated.

METALLURGY OF DRILLING EQUIPMENT

(Continued from Page 142)

to oxidation at high temperature and to corrosion exhibited by these alloys.

As the amount of alloy used is reduced, the rate of transformation increases; the austenitic structure can no longer be retained on quenching, resulting instead in martensite or a mixture of martensite and troostite. These structures are adjusted to meet requirements by reheating to the proper temperature, the operation being called "drawing" or "tempering."

Grain Size Control

Grain size can also be controlled to a considerable extent in heat treating. When the austenite crystals first form on heating, they are very small; and increase in size as the temperature increases above the transformation point and with time. The size of the grains in the quenched structure depends largely on the size of the austenite grains from which they were formed. As experience has shown that, in general, the finer grained steels have the best physical properties, it is evidently necessary to keep the size of the austenite grain as small as possible, always bearing in mind the fact that heating must be carried a little above the transformation temperature to be sure the transformation is complete, and that the piece must be held at temperature long enough to reach a uniform temperature throughout. Variations in weight, shape and alloy composition of product will control the procedure.

Combustional Properties

The foregoing discussion has dealt with

the composition and heat treatment of products where uniform properties are desired throughout the specimen. There are important cases, however, where combinational properties are desired. For example, the cutting edge of a fishtail bit must be very hard to take a keen edge and resist abrasion. Obviously, the microstructure must be principally martensite which, because of its brittleness, is entirely unsuitable for the shank and blade of the bit. The entire bit is, therefore, annealed producing a pearlitic structure; the cutting edge alone is reheated above the critical point; then quenched, retaining the required martensite structure, and perhaps drawing it back at a temperature of 400° or 500° to relieve the quenching strains. Of late the problem has been attacked from another angle: by welding to the cutting edges a very hard alloy which is practically unaffected by heat treatment. After this alloy has been applied, the bit as a whole can be normalized or annealed without affecting the cutting edge.

Still a different type of problem presents itself in the manufacture of rock bit rollers and cones. Here it is desirable that the entire surface of the parts be very hard, but the interior should preferably be soft to prevent the comparatively thin sections from cracking through. The problem is met by making the parts of a very low carbon steel, and then heating them for many hours in contact with some form of carbon. The carbon is absorbed by the steel, and a surface layer may be built up containing over 1 per cent carbon. When this high carbon skin has become thick enough, the parts are cooled, reheated to a temperature above the critical for the low carbon core, and quenched in oil. This refines the core, but the case has been somewhat overheated and, hence, the crystals are rather large and the fracture is brittle. This condition is corrected by reheating to a temperature just over the critical of the case, but below that of the core; and the parts are again quenched. This process is completed by drawing for an hour or so at about 350° to relieve quenching stresses.

The foregoing is a rather sketchy summary of the history of the introduction of heat treated alloy steel into rotary drilling equipment, and a still more superficial discussion of the manner in which the various problems encountered are attacked and the way in which heat treatment provides some degrees of control over the properties of available materials.

In the past, improved equipment has been produced as required by the increasing demands of deeper drilling. Present equipment will probably prove unsuitable in the years to come, but it may be confidently anticipated that an adequate solution will be found in which the metallurgical aspect will play an increasingly important part.

INSTITUTE ACTIVITY IS REVIEWED BY REESER

(Continued from Page 139)

duction Engineering of the Institute, organized and conducted in response to a demand from the industry for a forum in which drilling and producing problems could be investigated and discussed, has held meetings in the various producing districts throughout the year. The average attendance at these district meetings has been between 250 and 300. It was decided this year to concentrate effort on these district meetings, instead of holding the usual midyear meeting.

The divisional committee has laid out a definite program for the national study of particular production problems. Two problems were selected for intensive study this year, viz., straight hole drilling practice, and the use of air and gas for maintaining pressure and repressuring. Distinct progress has been made on both of these subjects, and a symposium summarizing the results of the year's investigations is being held during this annual meeting. The work of the production engineering division on straight hole drilling practice has been particularly marked. It has focussed the attention of the production branch of the industry everywhere on this important problem, to such an extent that various companies are now permitting only a small amount of deviation from the vertical—showing conclusively that problems of this sort are amenable to treatment and solution if we but devote co-operatively our time and attention to them. A bulletin, shortly to be issued for the benefit of the industry at large, will summarize the concrete results of co-operative investigation on these two problems, and it should be a positive contribution toward preventing undue waste or extravagant practice.

The Institute has financed and issued, in co-operation with the United States Bureau of Mines, a book entitled, "The Function of Natural Gas in the Production of Oil," which is a very valuable reference book on this important problem. It is a summarization of the data presented by a large group of technical men to the Committee on Gas Conservation, appointed and active in 1927. This book should be in the hands of every man interested or active in the production of oil. It is an invaluable contribution to one's technical knowledge.

One of the important developments in the field of co-operative work, related to production problems during the past year, has been the organization of local production men into local chapters in the various producing areas. These chapters have served directly the large number of field men whose duties are such that they could not attend district or annual meetings. Now they can meet at stated intervals and discuss their local problems, as well as make their contribution of knowledge and experience to the subjects that have been selected for national study. Several of these local chapters have been organized in Texas, Oklahoma, and Kansas. They have proved themselves a valuable source of information and education on field problems. Field men should be encouraged to organize and attend these chapter meetings, where they have full opportunity to exchange ideas and make suggestions.

The work of making specifications for standardized equipment is participated in by hundreds of practical, as well as technical, operators and equipment manufacturers. It is conducted through a Division of Standardization. The work with respect to production practice and methods is participated in by those members who are interested or engaged in production activity. It is conducted through a Division of Development and Production Engineering with appropriate committees.

Measuring, Sampling and Testing of Crude Oil

The Institute has undertaken to study the various methods now in common use for measuring, sampling, and testing crude oil for the purpose of setting up national standards wherever practicable and where agreement can be had. Special committees have been appointed (as announced in Institute Bulletin No. 6) for this year. The problem is an extremely complicated one because of the different practices that are widely used in various producing areas. In fact, many practices that have become well standardized in certain districts vary widely from those being employed in others. However, real progress has been made, and it is expected that a tentative code may be agreed upon, perhaps, at this meeting.

Conservation

Early in the year, the executive committee authorized the formation of a Committee on World Production and Consumption of Petroleum and Its Products. This committee was appointed and organized with regional committees and a general committee. A very large number of oil company executives participated in the committee's activity. R. C. Holmes was the general chairman; and, under his guidance, the committee developed and recommended a program for the conservation of crude petroleum, which involved fundamentally the curtailment of production in the several areas of the Western Hemisphere to 1928 figures. This program was approved by the Institute's board of directors, subject to approval by Federal and state conservation agencies. Such approval was not obtained, and the co-operative program proposed was not entered into. However, the work of the committee has borne fruit through the repercussion of its activity and discussions. Localized and independent action in the several domestic producing areas has, for the first time in many, many months, brought the production and consumption of crude oil into substantial balance.

Marketing Code

The most chronic maladies are the results of wrong methods of living, of bad habits, of errors in diet, et cetera. The cumulative effect of years of unhealthy living exhaust the vital resources of the body, with consequent suffering. The doctor follows the rational method of reversing the process. So it is with a business or an industry. In our marketing methods we have been leading an unhealthy life. We have admittedly gone to absurd extremes. The Code of Marketing Practices seeks to reverse the process. The Institute has performed yeoman service in furtherance of this attempted reformation. I am sure that for the past six months our executive vice president has devoted at least two-thirds of his time and energy in furtherance of code work alone, and the Institute has drawn heavily upon its treasury to meet expenditures for work pertaining to the code. Three hundred sixty-seven thousand copies of the code were printed and distributed.

No one can rightfully challenge the motive of this code. Its sole purpose is to correct evil practices and assist in the stabilization of the marketing end of our business. It is not designed to aid one marketer at the expense of another. Good business men will accept and follow it because it is a step in the right direction. There is no need to say what the bad business man will do, or why he will do it. If he were asked what he considered the objective of the code, he would surely answer: "The greatest good to the greatest number"; but if he were asked what he considered the greatest number, his answer would probably be: "Number one."

Individual Responsibility

Over 4,000 companies engaged in refining or marketing, have already notified the Federal Trade Commission of acceptance of the code without reservation. Those who refuse to accept and follow unreservedly a code which has gone through the mill of discussion and compromise, as this one has, are merely functioning as efficient clogs to prevent improvement of our marketing conditions. The head of a single oil company of any importance can easily succeed in putting the industry as a whole in the wrong light. One standpat, nonco-operative oil company executive can sometimes do more mischief than 100 progressive, co-operative executives can undo. Our hope for the code lies in the fact that men are sensitive to public opinion. The scorn of one's associates, or of the public, generally is a sharp whip. The esteem of one's fellowmen moves one more powerfully than the gain of money. That is human nature; and I ask who among you is the oil executive who will assume publicly the responsibility for breaking down the code or of preventing the other thousands who want it from making it effective?

Some, I know, of the executives of major and minor oil companies are taking this code very, very seriously, and have issued instructions to discharge instantly any employe who deliberately violates any of its provisions. I heard recently of the first casualty—of a district superintendent of a major company who was discharged for an overt act. More of this sort of prompt action will be understood. Your code will be 100 per cent effective, and violation will result only from misunderstanding or error. As business men, working for profits for our respective companies, craving the esteem of our fellowmen, bidding for public good will, let us not permit the code to fail; for failure may later cause us to flinch under the lash of memory and regret.

Tribute to W. R. Boyd

Business organizations are not operated successfully without sound, well balanced, and active management and direction. The Institute's constituency embraces a long list of strong and powerful business competitors. All of the "Who's Who in Oildom" are members. The duty of keeping the wheels in motion, of establishing and maintaining harmonious relations in and out of the industry, and of managing and supervising the Institute's general activities and business affairs is delegated by the board of directors to an executive vice president.

Fortunately for us, our executive vice president—"Bill" Boyd, as he is affectionately known to most of us—has not alone executive ability and managerial skill of the highest order, but he possesses, in addition that unusual type of personality, tact and infinite patience so essential to the successful management of an institution like ours. He eschews high-pressure methods. He does not blow his own horn. He works quietly, effectively, and without display. The industry has full and complete confidence in his integrity, his ability, and his absolute fairness. Bill Boyd's whole management policy seems to me to be founded on the sincere conviction that, in so far as he and his able staff of assistants are concerned, it is more blessed to give than to receive. He merits the confidence, the commendation, and the full and united support of the industry.

In conclusion, let me remind you, gentlemen, that this year 1929 has been a busy one in oildom. Hundreds of meetings of one kind or another of oil men have been held throughout the country for the purpose of discussion and action concerning common policies and procedure. The board of directors of the Institute has, almost uninterruptedly, met in regular monthly sessions. At these meetings, major problems affecting the industry as a whole—or an entire branch—have been wrestled with in all earnestness. It has not always been easy to obtain consensus of opinion or to reach common ground; but the purpose has been high and the effort sincere. I believe that our labors of this year will bear fruit. I believe that, with a determined, continuous, and ever-increasing will earnestly and honestly to co-operate for the common interest, we shall all profit, and that the petroleum industry will march steadily onward toward its goal of complete stabilization.

I conclude this story of the Institute as I began it: Co-operation is the cornerstone of power, stability, and progress.

MAGNETIC COMPASSES IN WELL SURVEY

(Continued from Page 146)

rection approaching that of the dip of the earth's field. For all other directions of axis, such a compass may be considered as highly dependable.

In surveying open holes, however, we can compare the relative merits of the two forms of compass about as follows:

A single bearing compass will not stay balanced on pivots unless the drill stem is vertical, and its effect has been compensated for. Influence of drill stem, on incline, tends to alter direction in which compass points. Can only be compensated for by long nonmagnetic sections.

Placing compass on gimbals permits greater inclination of drill stems without causing compass to bind; the drill stem must still be removed to a considerable distance with nonmagnetic material interposed.

Preferable for Surveying

A two bearing compass may be balanced for gravity and thereafter will retain balance for all positions of axis.

As mounted beneath drill stems, the axis of compass is always coincident

with axis of drill stems and hence stems cannot influence rotation of compass.

Presence of drill stem at short distance will change friction on bearings.

Cannot be operated with certainty in holes whose inclination is greater than 20° from vertical.

In general therefore, a two bearing compass should be greatly preferable for surveying bore holes whose inclination is less than 20° from the vertical, this limitation on angle of operation being the only serious one to be considered. A single bearing compass on the other hand must be removed to a considerable distance from the end of the drill stem by the interposition of acceptive nonmagnetic stems, before it can be relied on to function with certainty. Its sole advantage over the two bearing device is then that it can be used in holes of greater inclination.

In passing, it may be noted that if a two bearing compass must be mounted at closer distances from the end of the drill stem than would be otherwise advisable from a point of view of friction on the bearing, this drill stem component may be neutralized by placing above the compass, and between it and the end of the drill stem, a compensating magnet, as shown in Figure 11.

This compensating magnet should be so adjusted that the axial component of the field produced by it at the place where

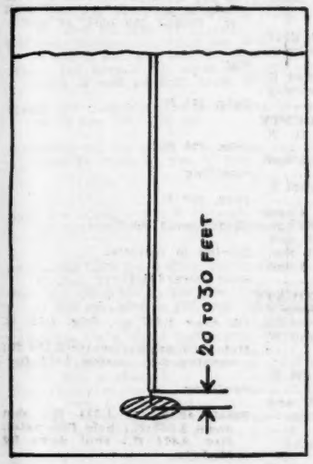


Figure 13.

the compass needle is located exactly equals the component produced by the drill stem. If this is done, and if the compass needle is counterweighted for the vertical component of the earth, a combination may be produced which may be inclined in any direction, without increasing the friction on the bearings by more than the slight amount due to the gravitational moment on the compass assembly, which may be kept very low by lowering the center of gravity of the rotating system until it is practically level with the sharp point on the shaft.

By placing the compass at a shorter distance from the drill stem, the amount of nonmagnetic stem required may be greatly reduced, thus lowering the total expense per installation, and greatly reducing the difficulties of transportation, since the nonmagnetic stem is the heaviest portion of the entire device.

Errors to Be Expected in Bore Holes

In considering the errors in direction to be expected from compasses when used in bore holes, we should first bear in mind the fact that the accuracy of magnetic bearing required is not very great. For ordinary service, it should suffice if we know the magnetic direction within 5, or even 10° of the accurate bearing, although closer readings than this are doubtless to be expected in practice.

Given a properly adjusted and compensated compass, whose direction should be normally that of the horizontal component of the earth's field, we should expect deviations in direction to occur principally due to local magnetic material, which would distort the horizontal component of the earth's field at this exact position.

The first cause of this nature which suggests itself is the presence of isolated masses of magnetic rock in the earth. Practical experience in magnetic measurements, however, indicates that such masses, except in very rare instances, cannot be expected to reach a magnetic value which would greatly disturb the compass bearings direction.

The second effect which suggests itself is the possible influence of drill stems and casings in nearby wells. This influence might at first be thought to be very pronounced, on account of the fact that surveys made with a compass show large deviations, when carried across an oil field covered with rigs. The presence of the machinery, piping, and moreover the upper ends of all of the casings, cause large deflections under these conditions.

It should be remembered, however, that none of these large masses is present under ground, and that we have to deal only with the possible effect of the casings and drill stems, and not with the rigs, machinery and piping existing at the surface.

Figure 12 shows a steel column, which may represent a casing or drill stem, placed vertically in the earth's field. Such a column acquires a magnetic polarity, and may be considered to act as a magnet. This polarity becomes more pronounced when the column has been subjected to vibration or jarring, such as is common during the drilling and placing of casings.

Magnetic Field

The magnetic field for this column has been sketched in Figure 12, and it will be seen that this field is practically vertical at all points except near the ends of the column. If we bring near such a column a compass whose direction is controlled by the horizontal component of magnetic fields, it can only be influenced by the presence of the column in such location as exists near the ends, where the direction of the magnetic force due to the column has a horizontal component of its own.

Vertical illustration. Figure 13 shows such a string of casing in place, with a "danger space" outlined near the bottom of the casing, within which the influence of the casing may be expected to produce noticeable horizontal components. A distance of 20 or 30 feet from the free ends of the casing is believed to be about the range of noticeable disturbance of this type. A very powerful magnet would be needed to extend noticeable field influence to a distance greater than 50 feet. Hence we can consider the theoretical danger space existing around the bottom of a casing or drill stem to be a very local

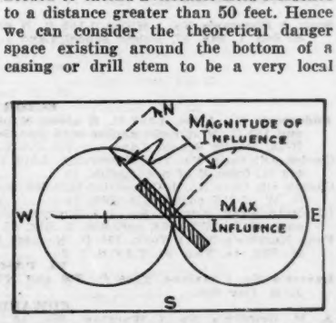


Figure 14.

affair, confined within a general space of 30 to 40 feet from the end of the stems itself.

Horizontal illustration. If our compass is located within such a danger space, the influence which will be exerted on it by the presence of the free end of a string of casings or drill stems will be further dependent on the direction in which this disturbing material lies. More possible positions are shown in Figure 14, and it will be readily seen from the illustration that the influence of drill stems placed either north or south of the compass needle will reach a minimum, while a maximum deflection could be expected from the presence of the same stem at the same distance but either east or west.

We see therefore, that the presence of drill stems or casings near our compass can be expected to produce deviation only if the compass is at the level of the bottom of the string, and then only if it is reasonably close to the string, and in an easterly or westerly direction from it. This reduces the possible effect of casing or drill stem to a very small value.

As a practical matter, in making surveys, or in following the direction of the hole, a series of readings would be taken at various distances down the hole. If one of these readings happened to occur opposite the end of an adjacent string of casing or drill stem, and within the "danger space," it would differ widely from the preceding and subsequent readings, and could therefore be noted as a "wild" reading, and discarded as such.

Readings Inside of Casings

A considerable debate has always existed as to whether a compass would indicate correctly when placed within a steel or iron pipe. The following discussion may help to clear up this point.

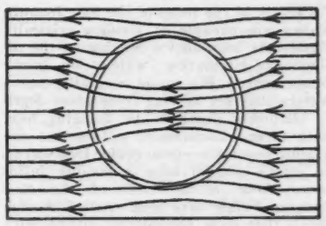


Figure 15.

Iron or steel passes magnetic flux more readily than does air. Hence a piece of casing such as is shown in section in Figure 15, when placed in a magnetic field, will cause most of the magnetic flux to be diverted and to pass around the sections of the tubing, while a relatively weak remnant of the field will pass through the air within the tubing. This weak remnant is still further reduced if several strings of tubings are placed one within another.

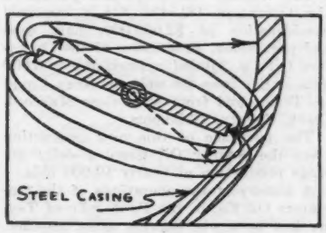


Figure 16.

A magnetic compass, however, is not influenced only by the presence of an external magnetic field due to other causes. It is capable of inducing, in any adjacent material which is not magnetized already, a local or induced magnetic field. Hence a compass within a soft steel casing such as is shown in Figure 16, if it approaches the wall of the casing, will induce in the nearest portion of that wall a local magnetic field which will attract the compass. Hence the nearest end of the compass will point strongly towards the nearest portion of the casing.

If such a compass is placed exactly in the center of the casing, it can not induce any stronger local field in any part of the casing than in any other part, and hence there is no tendency for the compass to point in any particular direction due to the field which it induces in the casing. Under these conditions, and within the limits imposed by the friction of the bearings, a compass needle within casings should point in the direction of the external earth's field. If, however, the compass is moved slightly from its central position in the casing, it will immediately induce a local field in the nearest portion of the casing, which may be many times as great an influence on its direction as the weak remnant of the earth's field passing through the casing. Under these conditions, a compass can not be expected to point in the direction of the earth's field, but rather in the direction of the nearest portion of the casing. Further than this, either end of the compass, depending on the one that is presented to the casing first, will be attracted by this nearest portion, so that the direction of such a compass cannot be expected to bear any consistent relation to the earth's field which it is desired to measure.

For use within casings, however, it is possible to construct other forms of device which do not induce local fields of their own, and which, therefore, can be made responsive solely to the remnant of the earth's field which is able to pass through the casing.

The control of wells while they are being drilled, however, does not involve any measurements made within casing, since the drill is always ahead of the casing at the point where the measurements are being made. Such measurements within casing are therefore of importance only in surveying previously drilled and cased holes, which procedure is not supposed to be the preferable manner in which to exercise control over drilling.

The compass principle described herein is incorporated in the Rieber well surveying system.

DETERMINATION OF GEOTHERMAL GRADIENTS

(Continued from Page 91)

waters ascending around the edges of the salt dome. A fourth, which seems less probable but which has not been disproved, is that there is or has been some heat releasing chemical reaction involved in the formation of the thicknesses of anhydrite that are commonly found associated with salt domes.

In the Panhandle district, a mountain of granite has been buried by sediments of Permian and Pennsylvanian Age. In Cooke County, Texas, a great uplift of Ordovician rocks has been buried by sediments of Pennsylvanian Age. Such conditions are commonly spoken of as "buried hills," and oil fields are quite commonly associated with them. The two districts mentioned are no exceptions. In both, there are profound unconformities, the Permian and Pennsylvanian sediments being millions of years younger than the rocks which they have buried. In both these districts, the rocks are comparatively cool. On the average, more than 100 feet of strata must be penetrated in order to reach a point where the temperature has increased by 1° F. However, there the similarity ends; for while in Cooke County the conditions seem to be quite uniform, so that measurements in one well seem quite like those in another—regardless of relation to geologic structure—in the Panhandle temperature conditions are quite different in different parts of the area; and it seems likely that further work will establish a relation between the position of a well with respect to high and low points on the buried granite hills and the temperatures encountered in that well. In neither area has the work been done in sufficient detail to justify conclusions as to the probable conditions responsible for temperature variations.

Regional Metamorphism

It has been suggested that the amount of pressure to which a region has been subjected should be reflected in the temperature. The work in Texas does not support this idea. According to this theory, the rocks in Cooke County should be warmer than those on the Bend arch; and these, in turn, should be warmer than the Cretaceous sediments along the Balcones fault zone. Exactly the reverse is true.

The work in Texas gives absolutely no support to the idea that oil pools are in any way responsible for high temperatures in the rocks associated with them.

CALIFORNIA

Geologic Conditions

The wells that have been available for temperature measurements in California are all in rocks belonging to a single period—the Tertiary. This means that compared to Oklahoma and Texas, the rocks that are involved in the California measurements represent a very short period of geologic time. Comparison of the California results with those in the

other two states may, therefore, give us some idea as to whether or not great periods of time have an important influence on temperature variations in the earth. It is the writer's preliminary impression that time is not an important factor, but further study is needed to confirm or disprove this idea.

Although the sediments in California are much younger than those either in Oklahoma or in Texas, except in the Gulf Coast, they have been much more intensely folded, and more profoundly faulted than have those in any of the areas studied in the other two states. It therefore, appears that in California the conditions are particularly suitable to study the temperature conditions in strongly deformed beds of comparatively uniform age.

It is felt that, although conditions for study of the effects produced by local structure are very favorable, the conditions for study of the influence of regional structure are not. The local effects are likely to be so strong that they will mask any regional influence that may exist. Furthermore, the distribution of oil fields does not favor study of regional structure. Finally, present ideas of the nature and origin of the regional structure are so vague that generalizations might be interesting, but would hardly be authoritative.

Too little is known about the comparative extent to which the rocks in different parts of California have been subjected to regional influences to justify any attempt to attribute observed differences to regional metamorphism. In fact, the measurements may help us learn about the regional metamorphism, but our knowledge of the regional metamorphism cannot help us interpret the distribution of temperature.

Plan of Work

The obvious impracticability of attempting any regional study led to an early decision to concentrate on the influence of local folding, and to work out the effects of local folding as thoroughly as possible. Santa Fe Springs was chosen for the first attack, and more than 30 wells have been measured in that field. Some of the measurements have been repeated at different times to make sure that they were accurate; and as an extreme check, some of the wells were retested by C. E. Van Orstrand, using different instruments from those used by A. J. Carlson. As a result of these checks, we are assured that the data secured in the California work are absolutely dependable.

When the work at Santa Fe Springs had progressed far enough to justify considering another field, the principal activity was transferred to the Long Beach Field; and now more than 30 wells in that field also have been tested with the same care as was exercised in Santa Fe Springs.

Results

A progress report, giving details of the work to date, has been prepared by A. J. Carlson, and is in process of publication by the American Petroleum Institute. No attempt is here made to give the results of this work, beyond stating that they appear to show quite conclusively that in fields of the Los Angeles Basin type the temperatures do reflect structure. Higher temperatures are found over the centers of domes or anticlines than near the edges of the folds. In the Long Beach district, the similarity between a map showing the contour of a surface of uniform temperature and one showing the geologic structure is so striking that it seems worth while to study the results in great detail, to see whether or not temperatures may not be used to indicate proximity of edgewater and also effects of local faulting. In Santa Fe Springs, the work thus far shows a general but not detailed, relation between earth temperature and geologic structure. Incidentally, this work emphasizes the importance of getting temperature measurements in wells outside of the producing limits, both to aid in the interpretation of the detailed work in the oil fields, and also to determine whether or not it is justifiable to draw conclusions based on temperature data as to the presence or absence of structure in wildcat wells.

Relation of Temperature to Petroleum

Thus far, the work in California has contributed nothing to help answer the question as to whether or not petroleum itself is directly or indirectly responsible for abnormal earth temperatures. True, comparatively high temperatures have been found in two oil fields, but these anomalies may better be attributed to the influence of structure than to chemical reactions involving petroleum. There is, however, one field in California where abnormally high temperatures, if present, might signify heat releasing chemical action. This is the Kern River Field of Kern County. Measurements in the synclinal and monoclinal parts of the Coalinga Field should also be significant, and it is hoped that the work will extend into those areas.

Relation of Temperature to Circulating Waters

Certain of the fields of the San Joaquin Valley are capable of yielding critically significant information bearing on the influence of circulating waters on earth temperatures. We would normally expect waters that are moving from great depth to shallower depth to be bringing heat with them. Conversely, waters that are moving down dip—from cooler into warmer strata—should have a cooling influence. Some of the fields of the San Joaquin Valley have been studied in such detail that it is possible to outline with reasonable accuracy areas in which certain sands contain waters that are moving downward from the outcrop, and other areas where the waters are either standing still or are moving up toward the outcrop. As yet, no temperature work has been done in these areas; but it is hoped that they will be studied before the work is concluded.

OPERATORS OIL CO. ABSORBED BY SUNRAY

The Sunray Oil Corp. has purchased the Operators Oil Co. for a reported consideration of $2,000,000, part cash and part stock. Production of the Operators Oil Co. totaled approximately 6,000 bbls. daily, from 20 wells in Gray County, Texas, and from wells near Manford, Creek County, Oklahoma.

The purchase of this new production gives the Sunray Oil Corp. a daily average production of nearly 10,000 bbls.

A history of the operations of the Operators Oil Co. in the Panhandle of Texas, has been one success after another. This is the second sale in less than a year.

The Sunray Oil Corp. recently bought control of the Homaokla Oil Co. and Anderson-Prichard Oil Corp., both of Oklahoma.

In addition to the production owned by the Operators Oil Co., there were also 17,000 acres of leases involved in the transaction, located in Texas and Kansas. The Operators Oil Co. also had three wildcat drilling tests which were included.

KANSAS ENGINEERS MEET

The Kansas Section of the Division of Development and Production Engineering of the American Petroleum Institute will hold its regular monthly meeting in El Dorado, Kans., and discuss the treatment of oil.

The discussion will be led by L. C. Ogden, petroleum engineer for the Empire Co. and well versed in the problems of treating oil field emulsions which have given considerable trouble in the Oil Hill and other districts in Kansas for many years.

FORM SALT WATER COMPANY

HOUSTON, Tex., Nov. 30.—Companies operating in the Barbers Hill Field have united to organize the Barbers Hill Salt Water Co., which will have as its purpose the disposal of the field's salt water. Wallace A. Belstrom of the Mills Bennett Production Co. was elected president; T. T. Word of Talbert & Markle, vice president, and Carl Bishop of Humphreys Corp., secretary-treasurer.

WILDCAT OPERATIONS IN WEST TEXAS

(Continued from Page 85)

COKE COUNTY

Lipan Oil Co.'s No. 1 E. C. Rawlings, Sec. 390, Blk. 1-A, H.&T.C. Sur., elev. 2,750 ft. ... Shut down 2,892 ft.
Mid-Kansas Oil Co.'s No. 1 W. E. Lackey, 330 ft. N and E of SW cor., Sec. 272, Blk. 1-A, H.&T.C. ... Pay 3,755-56 ft.; 6⅝-in. casing set 3,451 ft.; underreaming at 4,055 ft.; total depth 4,250 ft.

CONCHO COUNTY

Duffy et al's No. 1 Callan, 1,520 ft. N and 1,120 ft. W of SE cor., Sec. 21, Blk. 10, H.&T.C.R.R. ... Spudded and shut down.
Lamb & Slick's No. 1 Mosely, 2,490 ft. from N and 150 ft. from W of Sec. 1,338, Bachinan Sur. ... S. D. 451 ft.
Turner et al's No. 1 Borsig, 150 ft. from S of SE cor. G. Emig Sur. 130, 6 mi. W of Paint Rock ... Shut down 735 ft.

CRANE COUNTY

Church & Field's No. 4 University-Dewell, 2,310 ft. N and 990 ft. E of SW cor. Sec. 39, Blk. 30, University Land ... Flowed 400 bbls. 2,862 ft.; 6⅝-in. casing 2,700 ft.; total depth 2,998 ft.
Duffey et al's No. 7 Cowden Bros., 1,320 ft. from S and 1,420 ft. from E of Sec. 18, Blk. X, C.C.S.D.&R.G. N.G.R.R. Sur. ... Rigging up.
Gulf Prod. Co.'s No. 69 McElroy, 1,442 ft. S and 330 ft. E of NW cor. Gulf's lease, Sec. 185, Blk. F, C.C.S.D. &R.G.N.G.R.R. Sur. ... Top salt 1,180 ft.; drlg. 2,130 ft.
Gulf Prod. Co.'s No. 70 McElroy, 1,442 ft. S and 2,970 ft. W of NE cor. of Gulf's lease out of Sec. 201, Blk. 5, C.C.S.D.&R.G.N.G.R.R. Sur. ... Drlg. 1,275 ft.
Humble O. & R. Co.'s No. 2-D University, 990 ft. from W and 330 ft. from S of NW Sec. 34, Blk. 30 ... Top lime 2,858 ft.; swabbed 46 bbls. 24 hrs. 3,030-3,067 ft.
Republic Prod. Corp.'s No. 1 Hughes, 990 ft. from N and 1,650 ft. from W of their lease, Sec. 2, Julia Prather Sur. ... Drlg. 830 ft.
The Texas Company's No. 3 University, 330 ft. N and E of SW of N half Sec. 46, Blk. 30, University Land ... Top salt 1,005 ft.; drlg. 2,858 ft.
The Texas Company's No. 2 University-Beasly, 330 ft. S and E of NW of S half Sec. 46, Blk. 30, University Land ... Top lime 2,725 ft.; total depth 3,000 ft.; top pay 2,850 ft.; flowed 250 bbls. 24 hrs.
Tidal Oil Co.'s No. 2 University D, 330 ft. S and W of NE cor. NW of SW Sec. 34, Blk. 30, University Land ... Top pay 2,955 ft.; oil rose 2,000 ft. in hole; shot 160 qts. 2,955-3,025 ft.; flowed 200 bbls. 24 hrs.
Tidal Oil Co.'s No. 3 University-E, 330 ft. N and E of SW cor. E half of NW Sec. 39, Blk. 30, University Land ... Rig.
Warner-Quinlan Co.'s No. 6 University, 330 ft. S and E of NW of E half of SW Sec. 39, Blk. 30, University Land ... Drlg. 255 ft.

CROCKETT COUNTY

California Co.'s No. 1 Shannon, Lease 3, 1,663 ft. N and 2,323 ft. W of SE cor. Sec. 42, T.C.R.R. ... Drlg. 130 ft.
Cushing R. & G. Co.'s No. 3 Powell, 330 ft. from S and E of Sec. 53, Blk. BB, G.C.&S.F.R.R. Sur. ... Spudding.
Empire Gas & Fuel Co.'s No. 1 Shannon, 330 ft. from N and E of Sec. 42, T.C.R.R. Sur. ... Drlg. 830 ft.
Lewis & Daniels' No. 1 Pecos River Bed, 19 yards S and 37 degrees E of NW cor., Sec. 33, Blk. 1, I.&G.N. Sur. ... Shut down 1,384 ft.
Magnolia Pet. Co.'s No. 1 Hoover, 2,310 ft. from N and 330 ft. from E of Sec. 12, Blk. 1, G.C.&S.F.R.R. Sur. ... Moving in material.
T. P. Coal & Oil Co.'s No. 1 Shannon, 330 ft. from S and W of Sec. 44, T.C.R.R. Sur. ... Shut down 645 ft.

CULBERSON COUNTY

Grisham & Hunter Oil Corp.'s No. 1 fee, 330 ft. from S and W of Sec. 14, Blk. 59, T.&P. ... Oil show 1,437 ft.; drlg. 2,625 ft.
Grisham & Hunter's No. 1 Seay, 330 ft. from S and W of Sec. 16, Blk. 59, Twp. 7, T.&P.R.R. Sur. ... Hole full sulphur water 2,590 ft.; running 8-in. casing 2,605 ft.
Grisham-Hunter's No. 3 Seay, 330 ft. from S line, 330 ft. from W line, Sec. 16, Blk. 59, Twp. 7 ... Spudding.
Hickey & Stiver's No. 1 C. O. Finley, 600 ft. N and 1,980 ft. W. Sec. 20, Blk. 82 ... Small show oil 1,331 ft.; shut down 2,260 ft.; hole full water; elev. 3,374 ft.; shut down for 30 days.
West Coast Oil & Exploration Co.'s No. 1 McGregor, C NW, Sec. 14, Blk. 81 ... Slight show oil 740 ft.; shut down 825 ft.; repairing engine.
Scott & Dittman's No. 1 Miller, 1,160 ft. N and 2,480 ft. E. Sec. 1, Blk. 97, Public School Land ... Rainbow 1,056 ft.; 300 ft. sulphur water 1,725 ft.; oil show 2,538 ft.; hole full sulphur water; running 6-in. casing; shut down 3,508 ft.

ECTOR COUNTY

Anderson's No. 1 fee, 1,320 ft. E along N line, Sec. 19, and 150 ft. N at right angles with line, Sec. 18, Blk. B-16, Public School Land ... Moving in material.
Cosden Oil Co.'s No. 1-A University, 2,310 ft. from N. 440 ft. from E of Sec. 1, Blk. 35 ... Location.
Cosden Oil Co.'s No. 1 University-B, 1,650 ft. S and 440 ft. W of NE cor. Sec. 2, Blk. 35 ... Location.
Landreth Prod. Corp.'s No. 1-A University, 990 ft. S and 440 ft. W of NE cor. Sec. 2, Blk. 35 ... Location.
Penn-Humble's No. 1 York, 330 ft. N, 2,640 ft. W. Sec. 16, Blk. 44, Twp. 3s, T.&P.R.R. Sur. ... Drlg. 1,240 ft.

EL PASO COUNTY

Layter's No. 1 Malone, 2,200 ft. SW and NW, Sec. 46, J. M. Day Sur. ... Fishing tools 1,481 ft.

EDWARDS COUNTY

A. M. Griffith's No. 1 Wardlow, Sec. 60, V-8, J. C. Clift Sur. ... Shut down 3,000 ft.

FISHER COUNTY

Cranfill & Reynolds' No. 1 Bledsoe, 330 ft. N and E of SW SE, Sec. 200, B.B.B.&C.R.R. Sur. ... Drlg. 875 ft.
Landreth Prod. Corp.'s No. 3 Cooper, 330 ft. S and W of NE cor. Sec. 116, Blk. 1, H.&T.C.R.R. Sur. ... Drlg. 2,550 ft.
Magnolia Pet. Co.'s No. 1 Lee, Sec. 357, 2,310 ft. from N and 4,286 ft. from W ... Drlg. 3,724 ft.
Midwest Oil Co.'s No. 1 Steele, 660 ft. from S, 440 ft. from W, Sec. 210, Blk. 1 ... Show oil 2,940-45 ft.; top pay 3,192 ft.; shut down 3,193 ft.
Roeser-Pendleton and Amerada's No. 1 First Nat'l Bank of Waco, 660 ft. N and 600 ft. W of SE cor. NE of Sec. 204, B.B.B.&C. Sur. ... Drlg. 2,600 ft.

GAINES COUNTY

Louisiana O. & R. Co.'s No. 1 Ralph, 1,320 ft. from S and W of Sec. 7, Blk. A-28, Public School Land ... Drlg. 1,050 ft.; hole full water 830-48 ft.

GARZA COUNTY

Pandem Oil Corp.'s No. 1 Stokes, 2,310 ft. N and E of SW Section 32, Blk. 5, G.H.&H.R.R. Sur. ... Running 8-in. casing 2,300 ft.
Bell Thompson's No. 1 Tuffing, 330 ft. from S, 2,310 ft. from E, Sec. 10, Blk. 6, H.&G.N. ... Shut down 2,610 ft.

GLASSCOCK COUNTY

The California Co.'s No. 3 Currie, 990 ft. S and 2,310 ft. W of NE cor., Sec. 219, Blk. 29, W.&N.W.R.R. Sur. ... Shut down 2,345 ft.
California Co.'s No. 1 Jones, 330 ft. S from N and E lines, Sec. 25, Blk. 33, Twp. 2s, T.&P. Sur. ... Derrick.
Chal Daniel et al's No. 1 Meek, 2,310 ft. W and 1,600 ft. N of SE cor., Sec. 7, Blk. 34, Twp. 3s, T.&P. Sur. ... Shut down 1,147 ft.

Glasscock et al's No. 1 Edwards, 330 ft. from S, 1,650 ft. from E, Sec. 18, Blk. 33, Twp. 2s, T.&P.R.R. Sur... Cem. 6-in. casing 2,276 ft.; total depth 2,288 ft.

Kirby Pet. Co. et al's No. 2 Baker, 990 ft. S and 330 ft. E of NW cor. Sec. 23, Blk. 33, Twp. 2s, T.&P.R.R. Sur. ..... Topped lime 2,040 ft.; shut down 2,281 ft.

Lion Oil & Ref. Co.'s No. 3 Coffee, 990 ft. S and 330 ft. W of NE cor. Sec. 22, Blk. 33, Twp. 2s, T.&P.R.R. Sur. ..... Topped lime 2,053 ft.; setting pipe 2,068 ft.; S. D. 2,071 ft.

Shell Pet. Corp.'s No. 1 Coffee, 330 ft. from S and 1,650 ft. from E of Section 16, Blk. 33, Twp. 2s ..... Top pay 2,093 ft.; shut down at 2,239 ft.; plugged back to 2,137 ft.; swabbed 936 bbls. 18 hrs.

Simms Oil Co.'s No. 1 Coffee, 330 ft. from N and 1,650 ft. from E of Sec. 22, Blk. 33, Twp. 2s, T.&P. ..... Cem. 8¼-in. casing 2,059 ft.

E. L. Smith Oil Co.'s No. 2 Coffee, 330 ft. from S and 990 ft. from E of Sec. 15, Blk. 33, Twp. 2s, T.&P.... Drlg. 1,650 ft.

Sun Oil Co.'s No. 4 Phillips, 330 ft. N and 990 ft. W of SE cor. Sec. 14, Blk. 33, Twp. 2s, T.&P.R.R. Sur. ..... Top lime 2,085 ft.; drlg. 2,300 ft.

World Oil Co.'s No. 2-C McDowell, Sec. 21, Blk. 34, Twp. 2s, 330 ft. S and 2,310 ft. E of NW cor..... Rigging up tools.

HOWARD COUNTY

American Maracaibo's No. 2-B Settles, 990 ft. N and 2,310 ft. E of SW cor., Sec. 135, Blk. 29, W.&N.W. R.R. Sur. ..... Drlg. 2,654 ft.

Continental Oil Co.'s No. 2 Clay, Lease 1, 330 ft. N and 990 ft. E of SW cor. Sec. 127, Blk. 29, W.&N.W.R.R. Sur. ..... Drlg. 1,520 ft.

Continental Oil Co.'s No. 3-E Clay, 1,650 ft. N and 990 ft. W of SE cor. Sec. 138, Blk. 29, W.&N.W.R.R. Sur... Location.

Continental Oil Co.'s No. 3 Clay-F, 350 ft. S and 660 ft. W of NE cor., Sec 138, Blk. 129, W.&N.W.R.R. Sur... Show oil 2,595-2,675 ft.; shut down 2,998 ft.

Cosden Oil Co.'s No. 6 Roberts-A, 200 ft. N and E of SW cor., Sec. 129, Blk. 29, W.&N.W.R.R. Sur. ..... Shut down 1,456 ft.; sulphur water 1,433-46 ft.

Empire Gas & Fuel Co.'s No. 4 Clay, 330 ft. N and 2,310 ft. W of SE cor. Sec. 127, Blk. 29, W.&N.W.R.R. Sur. ..... Drlg. 340 ft.

Group No. 1 & Continental Oil Co.'s No. 8-A Settles, 990 ft. N and 2,310 ft. W of SE cor. Sec. 135, Blk. 29, W.&N.W.R.R. Sur. ..... Drlg. 2,910 ft.

Magnolia Pet. Co.'s No. 1 Snyder, 330 ft. from N and 990 ft. from W Sec. 36, Blk. 30, Twp. 1s, T.&P. R.R. Sur. ..... Location.

Magnolia Pet. Co.'s No. 13 Dora Roberts, 2,440 ft. N and 1,650 ft. E of SW cor. Sec. 136, Blk. 29, W.&N.W. Sur. ..... Shut down 2,927 ft.

Merriwether's No. 1 Smith, 150 ft. from S. 2,490 ft. from W. Sec. 45, Blk. 33 ..... Shut down 1,500 ft.

Midwest Exploration Co.'s No. 5-C Clay, 990 ft. from E and S Sec. 138, Blk. 29, W.&N.W.R.R. Sur. ..... Drlg. 600 ft.

Moody Oil Corp.'s No. 29-B, Sec. 137, Blk. 29, 330 ft. from N and 1,650 ft. from W ..... Top pay 1,890-1,911 ft.; preparing to test.

Moody Oil Corp.'s No. 28-B Roberts, 990 ft. from N and W of Sec. 137, Blk. 29 ..... Total depth 261 ft.; set 10-in. casing.

Plymouth Oil Co.'s No. 4 Abrams, 330 ft. from N and 1,650 ft. from W. Sec. 5, Blk. 32, Twp. 2s ..... Top pay 2,480 ft.; shut down 2,519 ft.; plugged back 2,505 ft. pumped 20 bbls., 15 per cent water, in 24 hrs.; may shoot.

Shell Pet. Corp.'s No. 2 Abrams, Sec. 13, Blk. 33, Twp. 2s, 2,310 ft. from S, 990 ft. from E, T.&P. ..... Top pay 2,135 ft.; pumped 1,025 bbls. 24 hrs.; total depth 2,215 ft.

Simms Oil Co.'s No. 2 Clay, 330 ft. from S, 2,310 ft. from W, Sec. 127, Blk. 29 ..... Drlg. 330 ft.

Ward Oil Co.'s No. 21 Roberts, 2,310 ft. N and 990 ft. E of SW cor. of Sec. 137, Blk. 29, W.&N.W.R.R. Sur. ... Drlg. 1,510 ft.

HUDSPETH COUNTY

California Co.'s No. 1 University, 3,821 ft. N and 2,554 ft. E of SW cor., Sec. 19, Blk. E ..... Drlg. 2,850 ft.

George Richardson's No. 1 Paxton, 2,640 ft. from N and W, Sec. 9, Blk. 16 ..... Shut down 305 ft.

Western States Oil Co.'s No. 1 Moore, C SE Sec. 16, Blk. 71, Twp. 6, T.&P. Sur. ..... Shut down 2,760 ft.

Western States Oil Co.'s No. 1 Gardner & Moseley, NE NW, Sec. 12, Blk. 18 ..... Shut down 3,140 ft.

IRION COUNTY

Banner's No. 2 Nutt, Subdivision 5, 150 ft. from N and E of W half Gonzales County School Lands ..... Plugged back 1,365 ft.; 3 bbls. salt water 1,400 ft.; shut down.

Beesley's No. 1 Sawyer Cattle Co., 1,320 ft. N and E of SW cor. Sec. 3,032, Blk. 24, H.&T.C.R.R. Sur. ..... Spudded and shut down.

Crawford Oil Co.'s No. 1 Williams, 450 ft. from N, 150 ft. from W, Subd. 8 ..... Shut down 1,105 ft.

Carl Cromwell's No. 1 Tankersley, 2,490 ft. from S and E, Sec. 1,319, T.C.R.R. Sur. ..... Shut down 375 ft.

Cromwell et al's No. 1 Fuller, 2,134 ft. N and 631 ft. W of SE cor., Sec. 31, Blk. 1, H.&T.C.R.R. Sur..... Fishing 710 ft.

Dennys & Andrews' No. 1 Tankersley, 2,660 ft. from W, 600 ft. from S of Sec. 4, H. N. Wallace Sur. ..... Fishing 529 ft.

Kingwood Oil Co. et al's No. 1 J. D. Suggs, SE NW SE Sec. 19, Blk. 7, H.&T.C. Sur. ..... Show gas 7 656 ft.; set 4½-in. casing 7,550 ft.; drlg. 7,770 ft.

J. A. Starkweather's No. 1 Lindley, Sec. 1,160½ ,900 ft. from S, 150 ft. from E, H.&T.C. Sur. on E ..... Drlg. 1,260 ft.

P. H. Williams' No. 1 Ash, C of Sec. 20, Washington County ..... Fishing 4,760 ft.

JONES COUNTY

J. H. Adsit et al's No. 1 Swenson, C of NE of SE, Sec. 192, B.B.B.&C. Sur. ..... Shut down 2,508 ft.

Cosden-Herbert et al's No. 3 Bickley, 330 ft. N and W of SE cor. of S half NW, Sec. 50, Blk. 16 ..... Rig.

Cranfill-Reynold's No. 1 Stevens, 990 ft. from N and 3,630 ft. from W of John McMullen Survey 337 ..... Drlg. 1,400 ft.

Mid-Tex Oil & Gas Co.'s No. 1 King ..... Shut down 1,520 ft.

Mid-Tex Oil & Gas Co.'s No. 1 Minter, 1,319 ft. from W and 765 ft. from N of Sec. 41, Blk. 15, T.&P. Sur. ... Shut down 1,904 ft.

Shabeen et al's No. 1 King ..... Drlg. 2,005 ft.

KENT COUNTY

California & Atlantic's No. 1 Wallace, 330 ft. from S and W Sec. 60, Blk. G, W.&N.W.R.R. Sur. ..... Location.

White & Smith's No. 1 Pursley estate, 1,320 ft. from E and 2,640 ft. from S of Sec. 8, Blk. H, H.&T.B. ..... Fishing 300 ft.

KIMBLE COUNTY

C. L. Bryant et al's No. 1 Lambert, 700 ft. from N and W line of F. Lotta Sur. ..... Shut down 800 ft.

McLean & Jamison's No. 1 Cannon, 1,940 ft. N and 300 ft. W of SE cor. Robert Cochran Sur. ..... Shut down 1,350 ft.

LOVING COUNTY

Humble Oil & Ref. Co.'s No. 1 Kloh, 2,640 ft. N and W Sec. 35, Blk. 55, Twp. 2, T.&P.R.R. Sur. ..... Drlg. 3,375 ft.

Independent O. & G. Co.'s No. 1 Wheat, 330 ft. each way from W cor. of Sec. 85, Blk. 1, W.&N.W. ..... Drlg. 2,250 ft.

Lockhart Co.'s No. 3 Allen, 330 ft. from NE, 1,650 ft. from NW, Sec. 32, Blk. 33, H.&T.C. ..... Top salt 725 ft.; cem. 6-in. casing 4,025 ft.

Lockhart & Co.'s No. 4 Hubbard, 1,660 ft. NE, 330 ft. NW, Sec. 33, Blk. 33, H.&T.C. ..... Shut down; top pay 4,194 ft.; shot 4,194-4,236 ft.; flowed 22 bbls.

LYNN COUNTY

Lubewell Oil Co.'s No. 1 May, 2,310 ft. S, 2,310 ft. W, Sec. 10, Blk. 7, E.L.R.R. ..... Shut down 190 ft. for casing.

George McCamey's No. 1 Edwards, 165 ft. N and E, Sec. 5, Blk. 2, L.S.&W. Sur. ..... Top salt 2,140 ft.; oil show 1,580-90 ft.; hole full sulphur water 4,730 ft.; set 6-in. casing 4,733 ft.; shut down 4,840 ft.

MENARD COUNTY

Cromwell & Duffey's No. 2 Winslow, 250 ft. S and E of NW cor. NE of NE Sec. 36, J. H. Gibson Sur. ..... Building rig

I. C. Barnett's No. 2 Callan, Sec. 1, 1,050 ft. from S, 1,190 ft. W ..... Est. 10 bls. show oil from 1,132-52 ft.; underreaming at 1,152 ft.; to deepen.

MITCHELL COUNTY

California Co.'s No. 3 Foster Lease 1, 1,100 ft. S and 990 ft. W NE cor. Sec. 6, Blk. 29, Twp. 1s, T.P. R.R. Sur. ..... Rigging up tools.

Gibson & Johnson's No. 2 Scott, 150 ft. N and 2,490 ft. W of SE cor. Sec. 7, Blk. 19, Lavaca Navigation Co. ..... Spudded and shut down.

Morrison et al's No. 1 Morrison, Sec. 1, Blk. 29, Twp. 1n, 2,390 ft. from N, 660 ft. from E, T.&P.R.R. Sur. .... Moving in material.

Morrison et al's No. 2 Morrison, 2,390 ft. from N and 660 ft. from E of Sec. 31, Blk. 28, Twp. 1n, T.P. R.R. Sur. ..... Location.

Seiger's No. 1 Scott, C of NE of SW, Sec. 36, Blk. 17, S.P.R.R. Sur. ..... Shut down 730 ft.

Texas & Wheeler's No. 1 Radford, 1,320 ft. N and W of Sec. 1, Blk. 27, T.&P. Sur. ..... Fishing 4,434 ft.

NOLAN COUNTY

Gibson & Johnson's No. 1 Bond, 1,320 ft. from N and 1,980 ft. from E of Sec. 42, Blk. 20, T.&P. ..... Drlg. 2,590 ft.

Phillips Pet. Co.'s No. 1 Plunkett, 330 ft. N and W of SE cor. NW, Sec. 66, Blk. 33, T.&P. Sur. ..... Underreaming 4,395 ft.

PECOS COUNTY

Anna Bell Oil Co.'s No. 1 Hollingsworth, 150 ft. N and W of C Sec. 24, Blk. 11, H.&G.N.R.R. Sur. ..... Moving in material.

E. W. Bateman's No. 1 Cunningham, 330 ft. from S and W line of NE Sec. 34, Blk. 11 ..... Drlg. 1,140 ft.

Black & Dittman's No. 1 Pecos Valley, 160 ft. from SW and SE lines Sec. 34, Blk. 3, H.&T.C.R.R. Sur. ..... Rigging up.

Buell & Hagan's No. 1 Byrne, 990 ft. from N and 2,310 ft. from E of Sec. 54, Blk. 10, H.&G.N.R.R. Sur. .... Drlg. 600 ft.

California Co.'s No. 6 Smith, Lease No. 1, 1,700 ft. N and 330 ft. W of SE cor. Sec. 37, Blk. 134, G.C. &S.F.R.R. Sur. ..... Derrick

California Co.'s No. 2 Tippett, 2,016 ft. from S and 1,040 ft. from E of Sec. 2, D.F. Robertson Sur. ..... Location.

Cardinal Oil Co.'s No. 1 Tippett, 330 ft. from S and E of Sec. 36, Blk. 12, H.&G.N.R.R. Sur. ..... Location.

Continental Oil Co.'s No. 2 University, 330 ft. S and 1,650 ft. E of NW cor. of Sec. 6, Blk. 17, University Land ..... Drlg. 400 ft.

Continental Oil Co.'s No. 3 University, 330 ft. S and 2,371 ft. E of NW cor. Sec. 6, Blk. 17, University Land ..... Total depth 938 ft.

Continental Oil Co.'s No. 4 University, 330 ft. S and 2,031 ft. E of NW cor. of Sec. 6, Blk. 17, University Land ..... Cellar.

E. W. Bateman et al's No. 1 Cordova, 3,490 ft. from N and 1,515 ft. from W Sec. 29, Blk. 11, H.&G.N.R.R. Sur. ..... Shut down 1,425 ft.

Crosby Prod. & Royalty's No. 3 Smith, 330 ft. from S and W line, Sec. 24, Blk. 194 ..... Cellar.

Cosden Oil Co.'s No. 1 McDonald, 350 ft. from N and E of Sec. 1, H.E.&W.T. ..... Drlg. 685 ft.

Cranfill & Reynolds' No. 1 Masterson, SW cor. Sec. 104, Blk. 10 ..... Top pay at 1,249 ft.; second pay 1,268 ft.; shut down 1,440 ft.

Dixie Oil Co.'s No. 1 McKinzie, 2,300 ft. from N and 2,025 ft. from W of Sec. 15, Blk. 604, G.C.&S.F. ..... Moving in material.

Freeman et al's No. 1 Pecos Valley, 150 ft. from NW and SW of NE half of S Sec. 36, Blk. 3, H.&T.C. .... Shut down 475 ft.

Harrison & Cromwell's No. 1 White-Baker, 2,310 ft. from S and E, Sec. 42, Blk. 11, H.&G.N.R.R. Sur. .... Oil show 822-27 ft.; drlg. 995 ft.

Humble Oil & Ref. Co.'s No. 1 Cunningham, C of SW Sec. 34, Blk. 11, H.&G.N.R.R. Sur. ..... Shut down 982 ft.

Independent O. & G. Co.'s No. 1 Phelps, 150 ft. N and W of N half of NE Sec. 28, Blk. 11, H.&G.N.R.R. Sur. ..... Drlg. 645 ft.

J. L. Kennedy's No. 1 Roberts, C of Sec. 78, Blk. 3, T.&P.R.R. Sur. ..... Drlg. 1,856 ft.

Sam Kitts et al's No. 1 Sherbino, 330 ft. from N and 990 ft. from W line, Sec. 52, Blk. C-4, G.C.&S.F.R.R... Top salt 976 ft.; shut down 2,490 ft.

Kirby Pet. Co.'s No. 1 Stockton Cattle Co., 330 ft. from N and E Sec. 2, T.C.R.R. Sur. ..... Machine.

Landreth Prod. Co.'s No. 1-D University, 990 ft. from S and 990 ft. from W of Sec. 31, Blk. 16..... Show gas 962 ft.; show oil 969 ft.; top pay 1,652 ft.; total depth 1,695 ft.; plugging back to 968 ft.

Landreth & Dunning's No. 1 McDonald, 330 ft. N and E of SW cor. Sec. 40½, Blk. 12, H.&G.N.R.R. Sur. .... Shut down 1,465 ft.

Landreth Prod. & Henshaw Bros.' No. 1-E University, 330 ft. N and W of SE cor. W half NE Sec. 13. Blk. 13, University Land ..... Drlg. 695 ft.

Landreth Prod. & Henshaw Bros.' No. 2-E University, 330 ft. S and E of NW cor. of W half of NE Sec. 13. Blk. 13, University Land ..... Cellar.

Landreth Prod. Corp. et al's No. 1-F University, 330 ft. from S and E of NE of SW Sec. 31, Blk. 16 ..... Top pay 964 ft.; total depth 968 ft.; hole full oil.

Landreth Prod. Co.'s No. 2-F University, 2,310 ft. from S, 1,650 ft. W Sec. 31, Blk. 16 ..... Drlg. 540 ft.

Landreth & Henshaw's No. 3 University-G, 330 ft. S and W of NE cor. of SE SW Sec. 31, Blk. 16 ..... Drlg. 1,270 ft.; top pay 972 ft.; 75 ft. oil in hole.

Landreth Prod. Corp. et al's No. 1-I University, 330 ft. from S and W of NE of NE Sec. 24, Blk. 13 ..... Total depth 931 ft.; set 10-in. casing.

Landreth Prod. and Henshaw Bros.' No. 2-I University, 330 ft. S and W of NE Sec. 24, Blk. 13, University Land ..... Cellar.

Landreth Prod. & World Oil Co.'s No. 6-B University, 990 ft. S and W of NE cor. of Sec. 13, Blk. 13, University Land ..... Total depth 1,056 ft.

Mauch & Kroger's No. 1 Holmes, Sec. 5, Blk. 178, T.C. Sur. ..... Cleaning out 1,442 ft.

Masda Oil Co.'s No. 1 Cordova Union Land Co., 2,310 ft. from N and 990 ft. from E of Sec. 103, Blk. 11, H.&G.N. ..... Spudded and shut down.

Merrick-Bristow's No. 1 Neville, 330 ft. from S and W, Sec. 42, Blk. 12, H.&G.N.R.R. Sur. ..... Top salt 645 ft.; shut down 1,676 ft.

R. E. Moore's No. 1 Arnold, 1,320 ft. from S and 660 ft. from E lines of Sec. 13, Blk. 1, H.&T.C.R.R. ..... Show oil 1,216 ft.; show oil 1,403 ft.; pulling 8-in. casing; total depth 1,428 ft.

Moncrief's No. 1 Sullivan, 150 ft. E of C of SW Sec. 58, Blk. 11, H.&G.N.R.R. Sur. ..... Spudding.

George Morgan's No. 2 Toborg, Sec. 539, Blk. 1, 150 ft. S of Moncrief's No. 1 ..... Show oil 1,208 ft.; total depth, 1,285 ft.; plugged back to 1,280 ft.; flowing 3 bbls. daily.

Mid-Kansas Oil & Gas Co.'s No. 32 Yates-A, 225 ft. N of most southerly N line and 1,308 ft. E of most western E line, Sec. 32, Blk. 194, I. G. Yates, Sur. A-3,195 ..... Shut down 1,515 ft.; top pay 1,435 ft.; flowed 2,030 bbls. per hour 1,510 ft.

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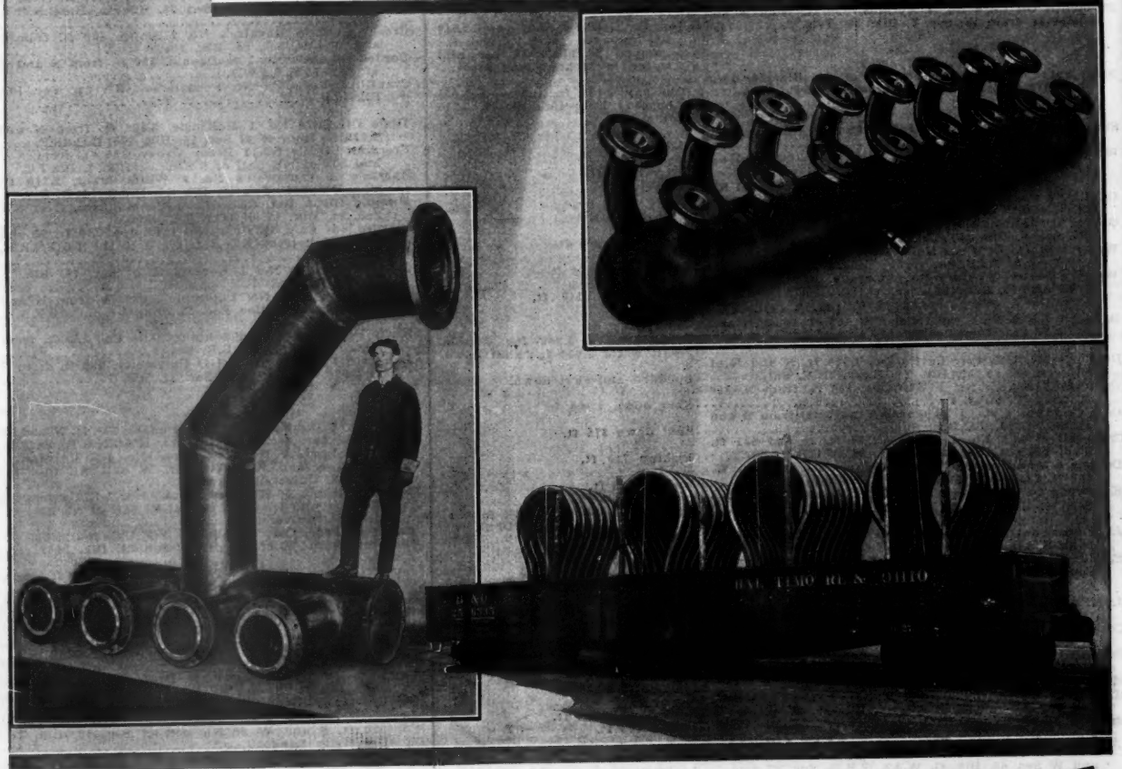

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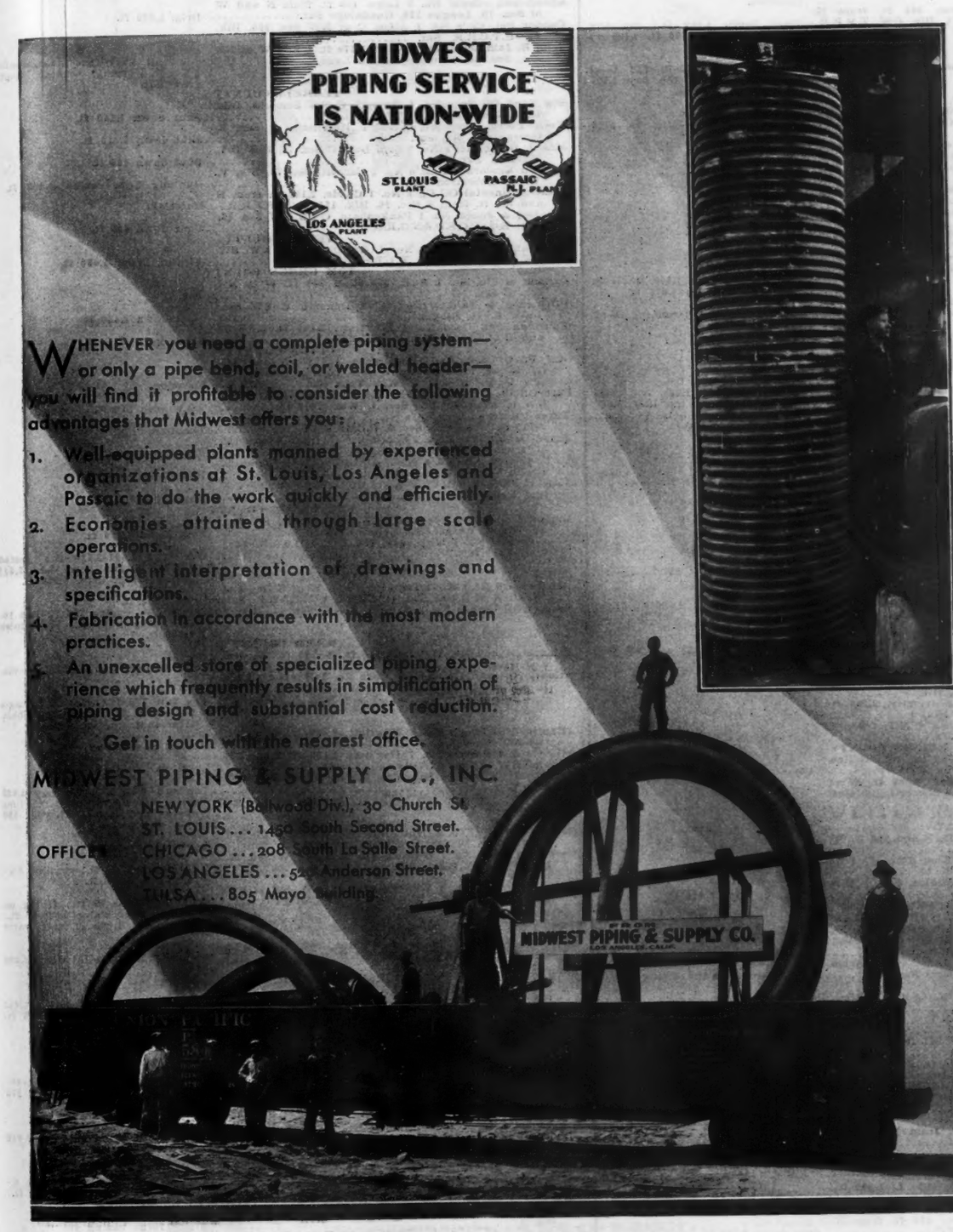
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H. T. O'dneal's No. 1 Power, 2,640 ft. from N and 150 ft. from W, Sec. 1, Blk. 132, T.&St.L.R.R. Sur. ....Shut down 40 ft.; running 10-in casing.
J. D. O'Mara's No. 1 Bennett, Sec. 592, 1,460 ft. from S, 150 ft. from E, G.C.&S.F. ....Fishing 875 ft.
J. D. O'Mara's No. 1 Streety, C of Sec. 1, W. P. Howard Sur. ....Drlg. 1,375 ft.
Pecos Crude Oil Pur. Co.'s No. 4 Pecos Valley, 770 ft. from SW and 1,320 ft. from SE of W Sec. 22, Blk. 10, H.&G.N.R.R. Sur. ....Location.
Phillips Pet. Corp.'s No. 3 Pryor, 365 ft. from N and 440 ft. from W of Sec. 78, Blk. OW, T.M.R.R..Total depth 1,389 ft.; top pay 1,380 ft.; filled 600 ft. with oil in first 32 hrs.
Phillips Pet. Co.'s No. 4 Ramsey, 2,722 ft. from N and 1,980 ft. from E of Sec. 17, Blk. 194, G.C.&S.F. ....Oil and gas 1,662-70 ft.; total depth 1,715 ft.; top pay 1,595 ft.; to plug back.
Rector Oil Co.'s No. 1 State Land, 330 ft. N and W of SE cor. Sec. 106, Blk. 8, H.&G.N.R.R. Sur. ....Shut down 1,410 ft.
M. M. Rowan's No. 1 University, NE Sec. 25, Blk. 16....Total depth 2,044 ft.; to plug back.
Schumaker et al's No. 1 Williams et al, 330 ft. N of middle of S line, Sec. 1, Blk. 117, G.C.&S.F. ....Drlg. 2,472 ft.
Shell Pet. Corp.'s No. 1 Percival, 330 ft. from N and E of SE Sec. 199, Blk. 2, I.&G.N. ....Location.
Sides & Cloyd's No. 2 Blackstone & Slaughter, C NW of Sec. 34, Blk. A-2, T.&C.R.R. Sur. ....Shut down 355 ft.
Skelly Oil Co.'s No. 1 University, 330 ft. from S and W of N half SE Sec. 31, Blk. 16 ....Shut down 1,023 ft.
Taylor-Link's No. 6 University, 330 ft. from N and 330 ft. from E of W half of SE, Sec. 15, Blk. 16 ....Fishing 985 ft.
Taylor-Link Oil Co.'s No. 8 University, 330 ft. N and 2,310 ft. W of SE cor. Sec. 31, Blk. 16, University Land ....Top pay 1,649 ft.; 1,400 ft oil in hole; total depth 1,675 ft.
Taylor-Link Oil Co.'s No. 9 University, 990 ft. N and 2,310 ft. W of SE Sec. 31, Blk. 16, University Land..Total depth 940 ft.; running 10-in. casing.
The Texas Co.'s No. 1 Graef, 4,758 ft. from W and 908 ft. from S of Sec. 44½, Blk. 12, H.&G.N. ....Spudding.
Trees Oil Co.'s No. 3 Trees, 330 ft. from S and W of Sec. 90, Blk. 8, H.&G.N. ....Machine.
World Oil Co.'s No. 1 University, 330 ft. from N and 2,310 ft. from E of Sec. 31, Blk. 16, University Land..6,000,000 ft. gas 1,630 ft.; total depth 1,665 ft.; top lime 1,630 ft.; flowing 55 bbls. per day, 30% b.s. and water.
World Oil Co.'s No. 2 University, Sec. 31, Blk. 16, 330 ft. from N, 2,310 ft. E ....Drlg. 105 ft.
Zoch et al's No. 1 Cordova Union Land Co., C of SW Sec. 81, Blk. 11, H.&G.N. ....Show oil 670-75 ft.; show gas 730-35 ft.; drlg. 1,455 ft.; show oil 1,350-60 ft.

PRESIDIO COUNTY

L. C. Brite's No. 4 Brite, 271 ft. from N, 1,188 ft. from E, Sec. 245, Blk. 4 ....Shut down 670 ft.
Eastland Oil Co.'s No. 1 Tootle, C Sec. 17, Blk. 1, D.P. R.R. Sur. ....Spudded; shut down.
T. P. Coal & Oil Co.'s No. 1 Bogel, 330 ft. S and W, Sec. 83, Blk. 3, G.H.&S.A. ....Gas show 2,810 ft.; drlg. 3,250 ft.

REAGAN COUNTY

Big Lake Oil Co.'s No. 1-C University, 2,598 ft. S and 250 ft. W of NE cor., Sec. 1, Blk. 2, University Land..Top pay 2,903 ft.; 1,000 ft. fluid in hole; top pay 6,807 ft.; shut down 8,000 ft. for 6-in. casing.
Big Lake Oil Co.'s No. 4-C University, 1,120 ft. from N and 1,096 ft. from E of Sec. 1, Blk. 2 ....Showing oil and gas at 8,220 ft.; flowed 303 bbls. in 24 hrs.; total depth 8,220 ft.
Texon Oil & Land Co.'s No. 2-B University, 4,655 ft. from S, 250 ft. from W Sec. 36, Blk. 9 ....Drlg. 1,925 ft.
Texon Oil & Land Co.'s No. 3-B University, 2,240 ft. from S, 920 ft. from W Sec. 36, Blk. 9 ....Drlg. 2,161 ft.
Thomas & Brann et al's No. 1 Hughes, C NE of Sec. 7, Blk. 1, T.C.R.R. Sur. ....Top salt 1,085 ft.; drlg. 1,788 ft.

REEVES COUNTY

Mac Best et al's No. 1 McKinney, 400 ft. from N line, 1,030 ft. from E line, Sec. 26, Blk. C-18 ....Cleaning out 840 ft.
Exploration Co.'s No. 1 A. A. Kinney, 1,500 ft. W of NE cor. Sec. 26, Blk. C-18, Public School Land, elev. 2,847 ft. ....Shut down 2,990 ft.
H. T. Hansford's No. 1 Williams, 150 ft. from S and W, Sec. 17, Blk. 6, H.&G.N. ....Pulling 15-in. casing.
Black & Fink's No. 1 Brooks, 1,980 ft. N and 660 ft. W, Sec. 16, Blk. 59 ....Shut down 500 ft.
Southern Crude O. P. Co.'s No. 1 Kioh-Rumsey, 2,310 ft. N and W SE cor., Sec. 23, Blk. 51 ....Coring 5,068 ft.
David R. Thompson's No. 1 A. A. Eddins, Sec. 9, Blk. C-1 ....Drlg. by casing 5,490 ft.

RUNNELS COUNTY

Gibson & Johnson's No. 1 Johnson, 2,310 ft. N and 1,650 ft. W of SE cor., Sec. 150, E.T.R.R. Sur. ....Spudding.
Gibson & Johnson's No. 2 Serratt, 2,310 ft. from S and 1,650 ft. from E of Sec. 150, E.T.R.R. Sur. ....Spudding.
Gibson-Johnson's No. 1 Woods, Sec. 529, 2,600 ft. from S and 300 ft. from E, T. T. Williams Sur. ....Underreaming 8-in. casing 2,575 ft.
H. E. Lamar's No. 1 Long, 2,310 ft. N, 6,900 ft. E Sec. 262 ....Shut down 1,375 ft.
McLean's No. 1 Clayton, 150 ft. from N line, 270 ft. from W line of Sec. 133 ....Shut down 1,185 ft.
Summer et al's No. 1 Reese, 600 ft. S, 720 ft. W Sec. 26, SE cor. ....Shut down 1,650 ft.
Vacuum Oil Co.'s No. 4 McMillan, 555 ft. S and 717 ft. W of NE cor., Lot 22, Dominco Diaz Sur., No. 532..Location.

SCHLEICHER COUNTY

Fort McKavet's No. 1 Tisdale, Sec. 1,499, River Section, 3,630 ft. from S, 150 ft. from W ....Set 6-in. casing 3,623 ft.; shut down 3,500 ft.
Interstate's No. 1 Whitten, 1,320 ft. from N and W, Sec. 35, Blk. LL, T.C.R.R. Sur. ....Hole slopped over with oil at 4,925 ft.; made one good flow; set 6-in. casing 5,050 ft.; total depth 5,565 ft.
George Wilson's No. 1 Page, Sec. 40, Blk. L, 1,200 ft. from N, 1,470 ft. from W, G.H.&S.A.R.R. ....Drlg. 745 ft.

SCURRY COUNTY

Byrd & Harmon's No. 1 Murphy, Jr., 330 ft. from N and E of Sec. 114, Blk. 97, H.&T.C. ....Shut down 1,732 ft.
Camp Spring Oil & Ref. Co.'s No. 3 Guinn, 1,300 ft. from S, 300 ft. from E, Sec. 12, Blk. 3, H.&T.C.R.R. Sur ....Drlg. 2,980 ft.
Cottingham & Briscoe's No 1 Trees, C SE Sec. 147, Blk. 97 ....Sulphur water 3,390 ft., total depth.
I. B. Mimms et al's No. 1 J. J. Koonsman' Sec. 216, Blk. 2, H.&T.C. Sur. ....Spudded and shut down 300 ft.
G. E. Dickman and R. B. Pender et al's No. 1 F. C. Davis, 1,900 ft. N and 1,770 ft. W of SE cor. of Sec. 275, Blk. 2, H.&T.C. Sur. ....Shut down 4,070 ft.
E. L. Smith Oil Co.'s No. 1 Moore, 1,320 ft. from S and W Sec. 379, Blk. 97 ....Drlg. 250 ft.

STERLING COUNTY

Sherwood B. Owen's No. 1 Tweedle, 1,980 ft. from N and 1,320 ft. from E of Sec. 10, Blk. T. T.&P. ....Drlg. 1,040 ft.

SUTTON COUNTY

Independent Oil & Gas Co.'s No. 1 Willson, Sec. 30, Blk. A, 1,650 ft. from N, 2,310 ft. from W ....Spudded and shut down.
Independent & Sun Oil Co.'s No. 1 Allison, Sec. 29, Blk. A, 200 ft. from N and 1,000 ft. from W ....Shut down 3,635 ft.
Phillips Pet. Co.'s No. 1 A. G. Holman, 2,310 ft. S and 330 ft. W NE cor., Sec. 25, G.C.S.D.&N.G.R.R. Sur....Fishing 6,625 ft.; making 1,500-000 ft. gas 6,625 ft.
L. G. Priest's No. 1 Allison, 1,320 ft. N and E of SW cor., Sec. 52, Blk. A, T.&P. Sur. ....Show oil 3,625 ft.; increase at 3,690 ft.; total depth 4,020 ft., plugged back to 3,655 ft.; shot 30 qts. 3,627-55 ft.

TAYLOR COUNTY

Adams and others' No. 1 Lowe, 150 ft. from N and W of Sec. 19, League 120, Guadalupe Sur. ....Drlg. 1,650 ft.
Condor Pet. Co.'s No. 1 Allen, C of NW Sec. 220, Blk. 64, H.T.C.R.R. Sur. ....Location.
John B. Jameson's No. 1 Webb, 1,170 ft. S and W of NE cor. Sec. 46, Lunatic Asylum Land ....Show oil 4,917 ft.; underreaming 5-inch casing; total depth 5,040 ft.

TERRELL COUNTY

Big Bend Oil Co.'s No. 1 Bassett, C NW Sec. 155, Blk. D, M.K.&T.R.R. Sur. ....Shut down 1,150 ft.
Keck Pecos Trust Co.'s No. 1 Hamilton, C Sec. 6, Georgetown Ry. Sur. ....Shut down 2,915 ft.
Mrs. J. B. McPhee's No. 1 Sam Belt, C Sec. 78, Blk. D-7, E.L.R.R. Sur. ....Shut down 880 ft.
Milham Exploration Co.'s No. 1 Bassett, Sec. 76, Blk. Y, W. E. Robertson Sur. ....Running 5-in. casing 5,400 ft.
Transcontinental Oil Co.'s No. 1 Goode, 2,152 ft. from E and 330 ft. from S Sec. 26, Blk. 161, G.C.&S.F.R.R....Material.
Woodley & Jones' No. 1 Pankenham, C SE NW Sec. 43, Blk. B-2, C.C.S.D.&N.G.R.R. Sur. ....Shut down 625 ft.

TERRY COUNTY

Kingsland, O. P. Co.'s No. 1 Brownfield, C NW SW SW Sec. 7, Blk. 1-A, E.L.R.R. Sur. ....Fishing bailer 5,030 ft.

TOM GREEN COUNTY

Cannon et al's No. 1 Rust, 990 ft. S, 990 ft. W of NE cor. of Sec. 745 ....Rig.
Fitzgerald & Taliaferro's No. 1 Bennett, C SW Sec. 1,628, E. H. Ringer ....Shut down 2,430 ft.
Fuhrman Pet. Co.'s No. 1 Wardlaw, 2,650 ft. from N and E of Sec. 6, Blk. 17, H.&T.C. ....Shut down 635 ft.

UPTON COUNTY

Gulf Prod. Co.'s No. 3-B Hughes, 150 ft. N and 161 ft. W of most southerly SE cor. of their 300-acre lease "B" out of Wm. Teer Sur. ....Location.
Pure Oil Co.'s No. 3 Hughes, 150 ft. S and 767 ft. E of NW of their 300-ac., Sec. 4, Wm. Teer Sur. ....Shut down 610 ft.
Texas Pacific C. & O. Co.'s No. 14-A Lane, 990 ft. N and 2,310 ft. W SE cor. Sec. 5, G.C.&S.F. ....Location.
Texon-Continental's No. 2 Sherk, 430 ft. from N line, 330 ft. from W line, Sec. 35, Blk. 1 ....Rig completed.
T. P. Coal & Oil Co.'s No. 1-D Lane, 430 ft. from S, 330 ft. W Sec. 36, Blk. 1 ....Rig.
T. & P. Coal & Oil Co.'s No. 1 Reese, 330 ft. from N and E line, Sec. 2, Blk. 3 ....Building road.

VAL VERDE COUNTY

Independent Operators' No. 1 Whitehead, SE SE Sec. 30, Blk. 4, I.&G.N. Sur., elev. 1,175 ft. ....Shut down 4,850 ft.
O. O. Owens, No. 1 Mills, Sec. 128, Blk. 1, I.&G.N. Sur., elev. 2,130 ft. ....Gas sand 2,491-2,520 ft.; tested 125,700 ft. gas; reset 8-in. 2,511 ft.; reaming; drlg. 4,920 ft.
Phantom Oil Co.'s No. 1 Ingram, 175 ft. W of E line and 300 ft. N of S line Sec. 44, Blk. D-8, E.L.&R.R. Sur...Drlg. 1,250 ft.
Valvert Oil Corp.'s No. 1 Bassett, C NE, Sec. 47, Blk. Y..Set 15½-in. casing 787 ft.; set 10-in. casing 1,510 ft.; shut down 4,009 ft.

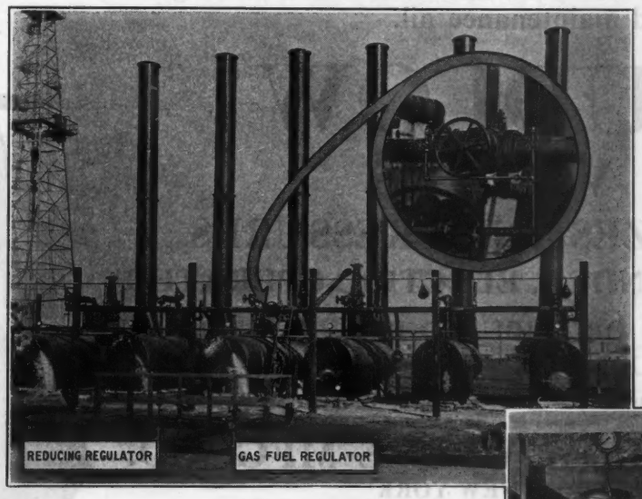
WARD COUNTY

Atlantic et al's No. 1 Dorr, 1,730 ft. S, 990 ft. W, Sec. 2, J. Howe ....Total depth 277 ft.; fishing casing.
Atlantic Oil and Delmar Oil Co.'s No. 5 Hayzlett, 2,420 ft. SW of NE line, 2,050 ft. NW SE of Sec. 17, Blk. 5, H.&T.C.R.R. ....Top salt 755 ft.; shot 220 quarts 2,462-2,502 ft.; flowed 174 bbls. after shot.
Atlantic & Delmar's No. 6 Hayzlett, 2,490 ft. from NE and NW lines Sec. 17, Blk. 5, H.&T.C. ....Moving in material.
Atlantic & Delmar's No. 7 Hayzlett, 1,650 ft. from NE and NW of Sec. 17, Blk. 5 ....Location.
Gulf Prod. Co.'s No. 2 Hutchins, 330 ft. N and E, Sec. 7, Blk. O ....Top salt 1,240 ft.; top pay 2,530 ft.; total depth 3,012 ft., lime shells and sand; flowed 190 bbls. daily.
Gulf Prod. Co.'s No. 3 Hutchins, 2,310 ft. from N and 330 ft. from W Sec. 1, Blk. F, G.M.M.B.&A. Sur. ....Moving in material.
Gulf Prod. Co.'s No. 7 O'Brien, 330 ft. S and W Sec. 22, Blk. F, G.M.M.B.&A. Sur. ....Total depth 2,530 ft.; running 8¼-in. casing 2,505 ft.
Gulf Prod. Co.'s No. 3 Wristen Bros., 220 ft. NE of SW and 220 ft. SE of NW Sec. 18, Blk. 5, H.&T.C. ....Show gas 1,960-70 ft.; filling up with sulphur water 2,520-27 ft.; shut down 1,000 ft. salt water at 2,545 ft.
L. C. Harrison et al's No. 1 Wristen, 990 ft. from S and W lines of Sec. 26, Blk. B-28 ....Top salt 700 ft.; total depth 2,390 ft.
E. B. Lovelace et al's No. 1 Redman, 1,980 ft. NE of SW line and 1,980 ft. SE of NW line, Sec. 162, Blk. 34, H.&T.C.R.R. ....Underreaming 10-in. casing; total depth 1,280 ft.; water 1,245 ft.
Penn & Atlantic's No. 2 Bennett, 2,310 ft. S line, 1,650 ft. W line, Sec. 16, Blk. 34, H.&T.C.R.R. Sur. ....Spudded 60 ft.
Penn & Atlantic's No. 1 Cooper, 330 ft. from NE and 990 ft. from NW of Sec. 43, Blk. 34, H.&T.C...Cellar.
Shipley's No. 3 Hayzlett, 2,490 ft. S, 1,470 ft. W Sec. 17, Blk. 5 ....Top salt 725 ft.; 2 bbls. oil 2,480-2,500 ft. sandy lime; shot 270 qts. 2,465-2,500 ft.
Shipley et al's No. 4 Hayzlett, 2,050 ft. NW of SE and 2,420 ft. NE of SW line of Sec. 17, Blk. 5, H.&T.C. R.R. Sur. ....Top salt 720 ft.; shut down 2,546 ft.; plugged back 2,538 ft.
Shipley et al's No. 5 Hayzlett, assume common line Secs. 16 and 17 is N and S 220 ft. S and 1,910 ft. W Sec. 17, Blk. 5 ....Plugged back from 2,546 ft. to 2,538 ft.; shot 90 qts. 2,473-93 ft.; no results.
Shipley et al's No. 1 Monroe, 330 ft. SE SW, Sec. 3, Blk. 1 ....Pulling 15-in. casing 605 ft.
Sun Oil Co.'s No. 1 Sealy, 330 ft. from N and E of Sec. 48, Blk. F, G.M.M.B.&A. Sur. ....Spudded 50 ft.
Sun Oil Co.'s No. 2 Sealy, 2,310 ft. from N and 330 ft. from W of Sec. 52, Blk. F, G.M.M.B.&A. Sur. ....Rig.

WINKLER COUNTY

V. T. Bolin's No. 2 Brown et al, 2,000 ft. S and W of NE, Sec. 4, Blk. B-5, Public School Land ....Top salt 1,300 ft.; shut down 2,832 ft.
Bashara et al's No. 2 Bashara, 990 ft. from S, 2,310 ft. from E, Sec. 17, Blk B-3, Public School Land ....Drlg. 477 ft., red bed.
Cinderella Syndicate's No. 1 Hendricks, 330 ft. N, 1,650 ft. W Sec. 42, Blk. 36, Public School Land...Total depth 150 ft.; building rig.
Humble O. & R. Co.'s No. 1-D Hendricks, 330 ft. from S, 2,310 ft. from W of Sec. 41, Blk. 26 ....Top lime 2,770 ft.; drlg. 2,894 ft., lime; top pay 2,812 ft.
Humble Oil & Ref. Co.'s No. 2 Walton, 2,310 ft. from N and W of Sec. 47, Blk. 26 ....Drlg. 240 ft.
Liner Drlg. Co.'s No. 1 Campbell, 330 ft. from N and E cor., Sec. 2, Blk. B-5 ....Top brown lime 2,510 ft.; shut down 3,280 ft.
Sun Oil Co.'s No. 2 Sealy, 2,310 ft. N line, 330 ft. from W line Sec. 52, Blk. F, C.M.M.B.&A. Sur. ....Location.

Claims vs. PERFORMANCE!



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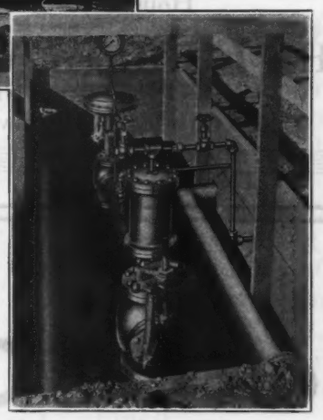

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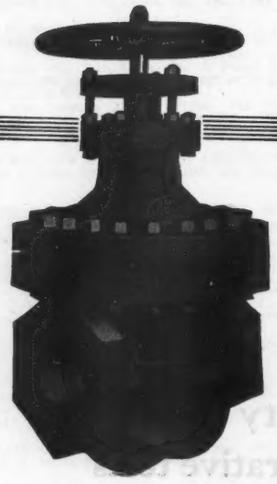

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Exchange National Bank Building TULSA, OKLA.

CENTRAL WEST FIELDS

(Continued from Page 82)

ship, the Ohio Fuel Gas Co.'s No. 2-4,868 George W. Vanfossen farm, Section 11, is dry in the Clinton lime from 2,604-18 feet, total depth 2,643 feet. Same company is rigging up to start No. 1-4,907 on the Peter Radcliff farm, Lot 120, Lick Township.

In Vinton County, Richland Township, the Ohio Fuel Gas Co.'s No. 2-3,595 H. and C. Wyatt farm, Section 3, was a duster in the Clinton lime from 2,386-98 feet, total depth 2,436 feet.

In Tuscarawas County, Washington Township, the Capital Drilling Co. made a location on the C. R. and M. A. Paulson farm, Sections 32 and 33. Phillips and others are drilling on the Ellen M. Couts farm, Section 21, Oxford Township, same county.

Stark County

In Stark County, Lawrence Township, Norwood Johnson is drilling on the Peter Kalesar farm, Section 8.

In Portage County, Franklin Township, Kline and others got a dry hole on the C. E. Miller farm. In Brimfield Township, the East Ohio Gas Co. has a slight showing of gas at 10 feet in a sand on the Cleveland Worsted Mitts Co. Lot 45. The Kline well was drilled to 604 feet.

In Guernsey County the East Ohio Gas Co.'s No. 3 E. C. Quillan farm, Section 11, Wheeling Township, is rated good for 60 bbls. initial in the Lima pay sand from 3,413-18 feet, the top of the Niagara being found at 3,242 feet. Ohio Fuel Gas Co. is drilling No. 2 on the J. C. Alloway, Section 10. East Ohio Gas Co. is drilling No. 4 E. C. Quillan farm, Section 11. Rallston Oil Co. is drilling a second test on the William T. Virtue farm, same section. Ohio Fuel Gas Co.'s No. 1-4,780 C. C. Wilson farm, same section, produced 83 bbls. initial. In this well the top of the Niagara was struck at 3,294 feet and lime pay sand from 3,461-71 feet.

In Belmont County, Somerset Township, Patterson & Peters' test on the Allen Price, Section 26, is a light gas well in the Berea sand from 1,791 to 1,815 feet. Same parties are starting a well on the John A. Vogt farm, Section 31.

In Harrison County, North Township, the Kemrow Co. got a duster on the C. K. Currant farm, Section 31, in the Berea from 1,203-13 feet, total depth 1,243 feet.

In Morgan County, Marion Township, Williams Brothers' No. 7 Curtis M. Ellis farm, Lot 4, was dry in the Maxon sand from 821-54 feet. Ohio Fuel Gas Co. made a location for No. 6-4,939 Hiram Thomas, Section 17, and also on the Frank Hammond, Section 11. Kemrow Co. is drilling on the James L. and Ida Boyd, Section 36. In Penn Township, Ohio Fuel Gas Co. has a light gas well in No. 7-4,821 H. C. Kennard, Section 3, and made a location for No. 1-4,948 Hobart Miller farm, Section 17. Same company made a location on the W. H. Coler farm, Section 26, Malta Township. Kemrow Co. found a fair gas well in No. 2 on the Henry J. Abel, Lot 16, Penn Township, and the Dover Oil Co. is drilling No. 22 Frank Gifford, Section 35, and the Penn Ohio Gas Co. drilling No. 3 C. E. Chase, Section 16. In Union Township the Buck Run Oil Co.'s No. 20 James C. Buckley, Section 2, pumped 5 bbls. from the first Cow Run sand from 104-25 feet. VanFossen & Scott are drilling No. 25 John Danahoo, Section 11, same township, and the Pure Oil Co. made a location on the Jacob Fisher farm, Section 20, York Township.

In Vinton County, Knox Township, H. C. Farmer's No. 1 John W. Stanley, Section 4, is reported showing for 5 bbls.

INDIANA

A few completions are reported from the Indiana fields, the most important one being Charles C. Taliferro, Jr., test, 1,000 feet from the south line and 200 feet from the west line of the Mary McAtee farm, SW, Location 12, Clay Township, Pike County, which produced 40 bbls. initial at a total depth of 1,235 feet or 8 feet in the sand. William Bell and others are drilling on the Fred Lindy farm, Section 31, same township. O. L. Diver is drilling on the Robert Walton farm, Section 14, Logan Township, same county.

In Prairie Creek Township, Vigo County, the Ohio Oil Co.'s test in the northwest corner of the W. C. Piety farm, NW, Section 32, pumped 15 bbls. initial from 2,231 feet. Siosi Oil Corp. is drilling No. 17 on the William Riggs farm, same section.

In the old Trenton Rock area of northeastern Indiana, O'Neil Brothers' second test on the John Teeter farm, Section 6, Jefferson Township, Adams County, pumped 10 bbls., the first 24 hours. George S. Lacknett is drilling No. 3 Otto Baker farm, Section 3, same township. August C. Ford, receiver, has abandoned No. 2 D. C. Boze farm, Section 7, same township.

V. V. Ford abandoned No. 1 on the Morris Weiler farm, Section 12, Jackson Township, Jay County.

In Noble Township, Wabash County, Max Ziegler & Brothers abandoned Nos. 1, 2 and 3 M. J. Barnett No. 1 farm, and Nos. 1 and 2 on the M. J. Barnett 100 acres, Section 14, also Nos. 1 and 2 on the A. J. Barnett No. 3 farm, same section.

ILLINOIS

The best of the late completions in the Illinois fields were made in the Dupo Field, Sugar Loaf Township, St. Clair County, south of East St. Louis. In this field the Ohio Oil Co.'s No. 21 on the Matilda Dyroff farm, NW, Section 28, pumped 150 bbls. initial from 466 to 520 feet, and the same company's No. 4 G. L. Tarlson farm, Section 33, same township, pumped 75 bbls. initial from 535 to 570 feet.

Kraft & McCullogh's wildcat on the Grover McCleve farm, Section 10, Hunt City Township, Jasper County, developed into a dry hole.

Big Four Oil & Gas Co.'s No. 25 well, 200 feet from the south line and 600 from the east line of the J. M. Buchannan farm, Sections 7 and 8, Bridgeport Township, Lawrence County, pumped 8 bbls. initial from 960 feet. The Ohio Oil Co. abandoned old No. 2 on the C. L. Lawson farm, SW, Section 10, same township.

In Crawford County, Prairie Township, the O. R. Gas & Oil Co.'s No. 2 on the William Akeman farm, NW, Section 1, pumped 2 bbls. from 1,050 feet. H. H. Weger is drilling on the J. M. Williams farm, Section 2, same township. Ohio Oil Co. is drilling No. 3 William Lamb farm, Section 26; Arkansas Fuel Oil Co. is drilling No. 1 A. J. Ikemire farm, Section 36, and the Porterville Oil Co. is drilling on the O. H. Smith, Section 36, all in the same township. Burns and Son are drilling on the Rachael Painter farm, Section 33, Honey Creek Township, same county.

Alspaugh and others' are drilling on the M. L. Briscoe farm, Section 33, Westfield Township, Clark County.

DRILL AT ELLICOTTVILLE

ELLICOTTVILLE, N. Y., Nov. 30.—The village of Ellicottville, Cattaraugus County, which boasts that it is the birthplace of more pipe liners than any other town, is to have another test for oil. Ellicottville, which was the birthplace of the famous Daniel O'Day, who headed the Standard Oil Co.'s entire pipe line system in the early days, has always been regarded as outside the oil country, but a few months ago a good showing of oil was reported in a test on Poverty Hill near the village, and now A. M. Greer and others have started a second test on the Greer farm.

FLAMES SEEN IN MIRAGE

CHATHAM, Ontario, Nov. 30.—A curious effect of the gas flares in the Turner Valley was observed recently, when, owing to unusual cloud combinations and atmospheric conditions, Calgarians 35 miles from the field saw all the numerous flares of the Turner Valley reflected in the sky. In the mirage the flares were seen inverted. The spectacle lasted for about an hour between 8 and 9 p. m.

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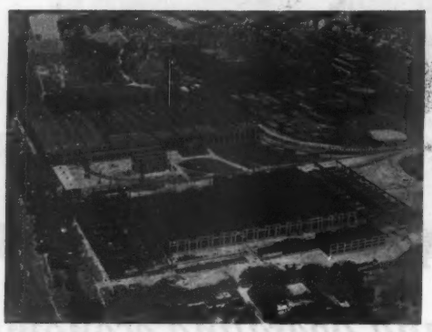

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OKLAHOMA FIELDS

(Continued from Page 66)

pool shows a daily average of 4,182 bbls. from 25 wells.

Sasakwa Pool shows a 2,600-bbl. decline from the previous week. The proration plan which is now working successfully is the principal reason for the decline. The daily average production was 9,103 bbls. from 30 wells. Harris & McNeal's No. 1 in C SW NE, Section 20-6-1, Cleveland County, was expected to be spudded by the first part of the week. This wildcat was west of the Asher Pool in the next county west.

Indian Territory Illuminating Oil Co.'s No. 1 McFarland, NW cor., Section 4-5-5, Pontotoc County, had a small showing of oil in the Wilcox sand at 3,142-45 feet, and casing was cemented at the top of the sand. After the cement plugs had been drilled the test began flowing sulphur water. It may be abandoned at this depth.

Greater Seminole Production

The average production of the various pools in the Greater Seminole area was 315,286 bbls. for the week ending November 27. The daily average gauges for the pools for the week ending November 27 were as follows:

Pool—	Wells	Bbls.
Little River	347	45,579
East Little River	47	22,555
Carr City	58	9,558
Maud	137	8,367
Mission	110	14,502
Bowlegs	295	25,698
Earlsboro	295	35,665
East Earlsboro	65	27,162
Seminole City	273	24,195
East Seminole	28	4,931
Searight	85	9,369
St. Louis	440	53,020
Asher	25	4,182
Sasakwa	30	9,103
Allen	237	21,410
Total Greater Seminole	2,472	315,286

The first 11 pools named constitute the Seminole Field. They averaged 227,471 bbls. from 1,740 wells for the same period, which is the week ending November 27.

The new well of the Shaffer Oil & Refining Co., its No. 3 Little Chief, NE cor. NW NE, Section 4-18-5, Payne County, averaged 1,700 bbls. daily for the last week, ending November 27, from the Mississippi lime at 3,285-3,322 feet. It is the largest producer in the area at the present time and also the only producer in this formation.

Prospecting in the West

A new core drilling campaign may be developed in Woods, Major, Woodward and Dewey Counties by major oil companies holding acreage in that region. Core drills may be used to follow the magnetometer survey parties which have been working in these areas during the past year. The wildcat tests now drilling in that part of the State are the Sinclair Oil & Gas Co.'s No. 1 Howell, C SW SW, Section 14-26-24w, Harper County, still fishing for rotary drill pipe at a total depth of 6,161 feet. Same company's No. 1 Stewart, C NE SW, Section 33-27-16w, Woods County, was drilling at 5,795 feet on November 29. Bu-Vi-Bar Petroleum Corp.'s No. 1 fee, SE cor. SW, Section 10-25-15w, Woods County, was drilling at 6,010 feet, in black shale, carrying a hole full of water. Prairie Oil & Gas Co.'s No. 1 Wilber, NE cor., Section 23-23-17w, Woodward County, was drilling at 5,875 feet in black shale. Harris & Haun's No. 1 Wyatt, C SE, Section 9-23-20w, Woodward County, is still fishing a bit at 4,969 feet. Peerless Oil & Gas Co. and Sinclair Oil & Gas Co.'s No. 1 Crowell, C NW NE, Section 23-28-16w, Woods County, has recemented the 15-inch casing at 1,075 feet. It is shut down at a total depth of 1,130 feet.

Several major oil companies that have been active in the southwestern counties are using torsion balance and magnetometer surveys and are blocking areas that are favorable. On a block in northeastern Tillman County, in Townships 1-16w and 1-17w, a wildcat test may be drilled to a depth of 1,700 feet. The majority of other tests in this vicinity have been drilled to about 1,000 feet, where the granite wash has been encountered. Coline Oil Co. may drill a wildcat test in the SW, Section 20-4s-1w, Carter County, but the exact location has not been announced.

In the Palacine area, Wirt Franklin Petroleum Corp.'s No. 1 Green, NW cor. SW NW, Section 9-2s-6w, Stephens County, was completed for 900 bbls. in sand at 3,166-88 feet. It made 620 bbls. on November 29.

West of Allen Pool

Barnsdall Oil Co.'s No. 1 Lusty, SW cor. NE Section 13-5-7, had water in the Wilcox sand at 4,268 feet and was plugged back to 2,760 feet in Cromwell sand, where the casing was ripped and the well made 503 bbls. of 25 gravity oil the first 24 hours. This test is located west of the Allen Pool.

McCulloch Oil Co.'s No. 1 Scott, NW cor. SW NE Section 23-6-8, Hughes County wildcat, has been abandoned at 4,610 feet. It had the top of the Woodford shale at 4,520 feet.

Lippa Drilling Co.'s No. 1 Pittman, SW cor. NW Section 3-8-4, Pottawatomie County wildcat, found the top of the Simpson at 4,397 feet, and it had water at 4,405 feet in the same formation. The test was drilling deeper at 4,440 feet on November 29.

Prairie Oil & Gas Co. and others' No. 1 Bodkin, SW cor. Section 26-8-4, Pottawatomie County, had Misener sand at 3,869-71 feet, and swabbed 115 bbls. in 24 hours. It flowed 105 bbls. the first 30 minutes and then went dead. It was later swabbed. The test was being drilled deeper on November 29, and was drilling in Hunton lime at 3 895 feet, with 1,500 feet of oil in the hole. This is a community test owned by six different oil companies, divided as follows: Prairie Oil & Gas Co. has 12/47, Empire Oil & Refining Co. has 8/47, Skelly Oil Co. has 8/47, Gypsy Oil Co. has 8/47, Phillips Petroleum Co. has 7/47, and the Twin State Oil Co. has 4/47.

Seminole Pipe Line Runs

The daily average pipe line runs from the Seminole area for the last week were 225,718 bbls., which amounts to a 6,000-bbl. decline over the previous week. Runs by companies for the week ending November 27 were as follows:

Company—	Bbls.
Barnsdall	2,880
Champlin	4,652
Consolidated	775
Cosden	9,145
Continental	515
Empire	4,940
Gulf	30,424
Magnolia	8,488
Oklahoma	40,746
Prairie	36,754
Producers & Refiners	1,065
Pure	3,245
Shaffer	4,015
Shell	7,075
Sinclair	24,716
Texas	16,098
Tidal	18,700
White Oak	1,987
Total	216,220
Tank cars	9,498
Grand total	225,718

Caddo County

Magnolia Petroleum Co. is erecting the rig for No. 3 Rowe, SE cor. NE NE, Section 36-6-10w. Bullock and others' No. 2 Royce, SE cor. SW NE, Section 12-5-9w, spudded and shut down. English Drilling Co.'s No. 1 Garner, NW cor. SW, Section 26-6-10w, has been abandoned at 3,465 feet. No. 4 Gaffney, NE cor. NW SE, Section 31-6-9w, made 125 bbls. in sand 3,278-87 feet.

Carter County

Ven Mex Oil Co.'s No. 1 Putman, NE cor. NW SW, Section 30-1s-3w, has been shut in for 48,000,000 feet of gas at 2,908 feet.

Cleveland County

Sooner Oil Co.'s No. 1 Vandeveer, C SW, Section 15-7-1w, has been abandoned at 3,120 feet.

Cotton County

Shasta Oil Co.'s No. 9 Slogan, C NW NE, Section 2-2s-10w, is flowing 100 bbls. from sands 2,126-28 feet and 2,142-54 feet.

Creek County

R. O. Bailey and others' No. 4 Walker, NW cor. SW SW, Section 21-18-9. is an old well drilling deeper at 2,729 feet. E. P. Harwell and others' No. 1 Colvin, NE cor. SW SW SE, Section 31-18-11, is a machine rigging up. Magnolia Petroleum Co. and others' No. 10 Eagle, CWL NW NW, Section 27-17-7, is drilling deeper at 2,835 feet. D. D. Mickelson's No. 1 Clover, CNL NW NE, Section 6-17-11, is spudding. Operators Oil Co.'s No. 2 Grayson, SW cor. SE SE, Section 17-19-9, made 5 bbls. in sand 2,342-72 feet. No. 3 Grayson, NW cor. SE SE, Section 17-19-9, has been completed for 40 bbls. in sand 2,260-2,304 feet. Tidal Oil Co.'s No. 3 Fife, CWL E half NW, Section 22-17-7, has been abandoned at 2,923 feet. Henry & Avers' No. 1 Harris, SE cor. SW SE, Section 12-17-10, is dry and abandoned at 2,499 feet. A. B. Ice's No. 10 Fulsom, SW cor., Section 13-17-10, made 50 bbls. in sand 1,907-28 feet. Pioneer Petroleum Co. & Darby Petroleum Co.'s No. 1 Barnett, SW cor. SE NE, Section 18-17-10, has been abandoned at 2,275 feet. Franchott Oil Co.'s No. 32 Kiefer, C W half W half SW, Section 17-17-12, has been completed for 15 bbls. in sand 1,474-1,511 feet. Atlantic Oil Producing Co.'s No. 1 Gooden, NE cor. SE, Section 15-14-10, has been abandoned at 3,420 feet.

Harmon County

S. M. Stauffer's No. 1 Cattleman, NW cor. SE, Section 8-4-26w, has been abandoned at 625 feet.

Hughes County

The Prairie Oil & Gas Co. made location for No. 2 Canard, SE cor. NE NW, Section 28-9-10. E. W. Whitney's No. 1 Huddleston, SE cor. SW, Section 17-5-9, has been abandoned at 3,935 feet.

Kay County

Wentz Oil Corp.'s No. 3 Purty, SW cor. NE, Section 17-28-1, made 946 bbls. from sand 3,265-69 feet.

Kiowa County

Alexander and others' No. 1 Prough, SW cor. NW SW SW, Section 17-6-16w, is drilling at 155 feet. I. D. Flanary's No. 1 Reneau, SW cor., Section 25-6-18w, has been abandoned at 1,003 feet. Continental Oil Co.'s No. 2 School Land, NE cor. NW, Section 36-17-3. made 10,000,000 feet of gas in sand 3,900-37 feet.

McIntosh County

Western Natural Gas Co. moved a machine in for No. 2 Coon, NW cor. SE NW, Section 21-11-17.

Muskogee County

John Aggas' No. 2 Wheat, NE cor. SE SW, Section 28-16-15, is drilling at 150 feet. E. B. George has a machine on the ground for No. 2 Caesar, SW cor., Section 33-14-16. J. R. Graves and others' No. 1 Davis, SE cor. NE. Section 14-13-16, is a machine. C. F. Ray and others moved a machine in for No. 1 Weaver, SE cor. SW SE, Section 15-13-18. Bryan Petroleum Co.'s No. 2 Simmons, CSL NE SE, Section 4-15-15, has been completed for 6 bbls. in sand 1,600-06 feet. W. J. Metzger and others' No. 11 L. Francis, SE cor. SW NW SW, Section 1-14-18, has been completed for 30 bbls. in sand 922-44 feet. C. F. Ray and others' No. 1 Foreman, NE cor. SW SE, Section 15-13-18, has been completed for 2,000,000 feet of gas in sands 596-618 feet and 687-84 feet. E. Mills and others' No. 1 Foreman, NE cor. SE SE, Section 15-13-18, has been abandoned at 730 feet. H. Burke's No. 1 Morris, CNL SW NW, Section 24-13-18, has been completed for 750,000 feet of gas in sand 620-45 feet.

Noble County

Mid-Co Oil Co. has a machine on the ground for No. 16 Case, C SW NE, Section 29-24-1w.

Okfuskee County

Sun Ray Oil Co. & Shelden moved a rig in for No. 3 Wilson, NW cor. SW, Section 22-12-11. Champlin Oil & Refining Co. made location for No. 15 Jacobs, NW cor. SE SE, Section 15-11-11. Champlin Oil & Refining Co.'s rig is up for No. 8 Washington, NW cor. NE SE, Section 15-11-11. F. A. Havel and others' No. 1 Grayson, SW cor. SE, Section 23-11-11, is rigging up to deepen from 1,644 feet. Moffett and others' No. 1-A Wilson, NE cor. SW NE, Section 26-11-11, is a rig on the ground. Riverside Oil Co. & Billingslea's No. 1-A Blackman, NW cor. SW SW, Section 33-11-11, is drilling at 1,100 feet. The Prairie Oil & Gas Co. & T. B. Slick's No. 1 Wolf, SW cor. NW, Section 18-12-10, has been abandoned at 3,949 feet. Independent Oil & Gas Co.'s No. 1 McNac, NW cor., Section 33-12-10, is dry and abandoned at 3,847 feet. Atlantic Oil Producing Co.'s No. 1 Snell, NE cor. SW NW, Section 13-10-11, is a dry hole at 2,116 feet.

Oklahoma County

Indian Territory Illuminating Oil Co. has a cellar in NW cor. SW SW, Section 24-11-3w, for No. 2 Speegle. Sinclair Oil & Gas Co. and Amerada Petroleum Corp.'s No. 3 Kinter, NW cor. SW SE, Section 30-11-2w, is a location. Same company's No. 4 Kinter, SE cor. SW SE, Section 30-11-2w, is also a location. Tom Slick Oil Co. has made a location for No. 1 Hoopes, NW cor. SW NE, Section 31-11-2w. Skelly Oil Co.'s No. 2 Hoopes, SW cor. NW NE, Section 31-11-2w, is a location. Sinclair Oil & Gas Co.'s No. 1 Bence, NW cor. NW SE, Section 31-11-2w. is a location.

Okmulgee County

Sheridan Oil Co.'s No. 4 Peters, CNL SE SE, Section 33-16-11, is drilling at 675 feet. J. H. Rebold's No. 3 Brooks, CSL SW NE, Section 6-15-13, is a cellar. Devonian Oil Co.'s No. 1 Jones, SE cor. NW, Section 6-15-13, made 20 bbls. in sand 2,590-2,604 feet. No. 1 Scott, NW cor. SE, Section 6-15-13, has been abandoned at 2,615 feet. Denton & Marshall's No. 1 McKinney, NE cor. NW, Section 16-15-14, is dry and abandoned at 2,410 feet. C. D. Burns' No. 4 Stevens, C SE SE, Section 1-14-12, has been abandoned at 2,774 feet. I. M. Levine and others' No. 1-A Warner, NW cor. SE NW, Section 24-14-12, made 1,000,000 feet of gas in sand 1,608-15 feet after plugging back from 1,945 feet. J. L. Selby's No. 17 Flint, SE cor. NW NE, Section 26-14-14, has been completed for 500,000 feet of gas in sand 539-45 feet. Simms Oil Co.'s No. 6 Grayson, CSL SE SW, Section 16-13-14, has been abandoned at 2,030 feet. Penrod & Thompson and others' No. 11 S. Fox, CSL N half SE NW, Section 22-13-14, has been completed for 15 bbls. in sand 2,475-87 feet.

Osage County

Winona Oil Co. moved a machine in for No. 9 CSL N half NE, Section 20-29-9. Peters Petroleum Co. and Producers & Refiners Corp.'s No. 2, NE cor. SE NE, Section 10-26-8, is a rig under construction. Stanley and others' No. 2, SW cor., Section 10-25-8, is spudding. Indian Territory Illuminating Oil Co. is moving the rig in for No. 1, NW cor. NE SW, Section 32-23-10. L. G. Stanley and others' No. 3, NW cor. NE, Section 14-21-8, is a machine. Oklahoma Natural Gas Corp. has a machine on the location for No. 1,748, SE cor. NW, Section 35-21-11. Oklahoma Power & Water Co.'s No. 128, NW cor. SW SW, Section 4-20-10, is spudding. No. 127, NE cor. NW NW, Section 9-20-10, is spudding. Minnehoma Oil Co.'s No. 5, NE cor. NW NW SW, Section 11-26-8, is dry and abandoned at 2,577 feet in siliceous lime. Indian Territory Illuminating Oil Co.'s No. 419, NE cor. SW NW SE, Section 8-25-11, has been completed for 3,500,000 feet of gas in sand 1,936-45 feet. Union Oil & Mining Co.'s No. 2, SW cor. SE NW, Section 32-23-10, has been completed for 200 bbls. in Siliceous lime 2,546-59 feet. Mundy and others' No. 2, NE cor. SE, Section 10-21-8, made 30 bbls. in Bartlesville sand 2,385-2,402 feet. Oklahoma Natural Gas Corp.'s No. 1,744, NW cor. NE SW SW, Section 5-21-12, has been completed for 67,000 feet of gas in sand 873-82 feet.

Pawnee County

Sample and others' No. 1 Sample, SW cor. NW NW. Section 36-20-8, is rigging up. Nadine Oil Co.'s No. 5 Martin, NW cor. NE NW NE, Section 7-20-8, has been completed for 200 bbls. in sand 2,475-97 feet after plugging back from 2,503 feet. McMan and others' No. 2 Johson, NE cor. SE, Section 27-20-9, made 65 bbls. in Red Fork sand 2,140-64 feet. Swift and others' No. 6 Smelzer, SW cor. NE, Section 35-20-9, made 125 bbls. in Red Fork sand 1,972-95 feet. H. Purser and others' No. 1-A Miller,

SE cor. NE SE, Section 20-20-10, is dry and abandoned at 2,249 feet. John Markham's No. 7, SE cor., Section 14-21-7, made 7 bbls. from Layton sand 1,343-1,400 feet.

Payne County

Shaffer Oil & Refining Co.'s No. 3 Little Chief, NE cor. NW NE, Section 4-18-5, made 1,972 bbls. in sand 3,300-19 feet. Transcontinental Oil Co.'s No. 2 Lincoln, SW cor. SE, Section 4-18-5, has been completed for 180 bbls. in Wilcox sand 3,616-29 feet.

Pittsburg County

Midwestern Oil & Gas Co.'s No. 1 Benedict, SW cor. SE SE, Section 10-7-18, is rigging up.

Pontotoc County

Independent Oil & Gas Co. made location for No. 2 L. Davis, SE cor. NW SW, Section 19-5-5, Bebee Pool. Denver Producing & Refining Co. has the cellar dug for No. 2 Jones, NE cor. SE NE, Section 36-5-4. Texas Pacific Coal & Oil Co. moved the rig in for No. 3 Hatcher, NW cor. NE NE, Section 30-5-5. Bendum & Trees Oil Co.'s No. 1 Stafford, NE cor. SW NW, Section 31-5-5, has been completed for 148 bbls. in Viola lime 2,487-2,661 feet.

Pottawatomie County

Dillon Development Co.'s No. 1 Earlsboro Townsite, Block 18, Lot 10, NE cor. SE SW NW, Section 8-9-5, is a rig. Anderson & Campbell and others' rig is up for No. 1 Earlsboro Townsite, Block 11, Lot 9, NE cor. SW NW, Section 8-9-5. Keister & Manning moved the rig in for No. 1 Rowlett, SE cor. SW NE, Section 30-8-4. The Texas Company's No. 1 Lynn, SE cor., Section 20-7-4, is a rig on the ground. Empire Oil & Refining Co.'s No. 2 Bettis, NE cor. SE SE, Section 17-7-4, has been abandoned at 4,239 feet. Pure Oil Co.'s No. 1 Brandenburg, NW cor. NE NW, Section 21-7-4, Pearson area, made 430 bbls. from Hunton lime 3,713-4,007 feet, total depth 4,230 feet. Magnolia Petroleum Co.'s No. 1 Denton, NE cor. NW SW, Section 22-7-4, has been completed for 13,000,000 feet of gas in Hunton lime 3,585-3,650 feet. No. 4 Billington, SW cor. NE NW, Section 22-7-4, flowed 1,154 bbls. from Simpson sand 4,265-75 feet. Diegnan and others' No. 1 Asher Townsite, C S half, Block 39, CWL SE SW, Section 18-6-4, has been abandoned at 3,944 feet. Superior Oil Corp. & Gypsy Oil Co.'s No. 1 Blackbird, SE cor. NE NW, Section 19-6-4, is dry and abandoned at 3,806 feet. No. 2 Blackbird, NE cor. SE NW, Section 19-6-4, has been abandoned at 3,685 feet. The Prairie Oil & Gas Co. & T. B. Slick's No. 1 Walters, NW cor. SE SE, Section 12-7-4, is a rig.

Rogers County

J. E. Sewell and others' No. 1 Hawkins, SE cor. NW SE, Section 29-19-17, is dry and abandoned at 473 feet.

Seminole County

Amerada Petroleum Corp. and others' moved the rig in for No. 1 I. Brown, SE cor. NE NE, Section 22-9-5. Gypsy Oil Co.'s No. 2 Taylor, NE cor. SE SW, Section 19-9-6, East Earlsboro Pool is a cellar. Carter Oil Co.'s No. 2 Chowning, NW cor. SW SW, Section 19-9-6, is a cellar. Wofford Drilling Co. and others' No. 1 Davis, SE cor. NW, Section 29-8-7, is a rig under construction. Gypsy Oil Co.'s No. 12 Hulhoke, SE cor. SW SE, Section 14-7-6, Little River Pool is a rig being built. The Prairie Oil & Gas Co. made location for No. 6 C. Talley, SE cor. SW, Section 14-7-6. Barnsdall Oil Co. is erecting the rig for No. 1-A Cotcha, NW cor. NE, Section 23-7-6. Pure Oil Co.'s No. 13 Cotcha, NE cor. NW NE, Section 23-7-6, is rigging up. McCulloch Oil Co. made location for No. 1 Snyder, SE cor. SW NE, Section 8-6-6. E. L. Harris made location for No. 2 Harjoche, NE cor. SE SE, Section 8-6-6. Champlin Oil & Refining Co. and Empire Oil & Refining Co.'s No. 1 Skinner, SW cor. NW SW, Section 9-6-6, is a rig on the ground. Mid-Continent Petroleum Corp. is building the rig for No. 5 Harjo, SW cor. SE NE, Section 14-5-7.

McCulloch Oil Co. and others' No. 1 Luckett, NE cor. NW, Section 28-10-5, is dry and abandoned at 4,904 feet. Gypsy Oil Co.'s No. 1 Saloche, SE cor., Section 31-10-6, has been completed for 60 bbls. at 4,100 feet after plugging back from 4,340 feet. Skelly Oil Co. and others' No. 2 Varnum, NE cor. NW NW, Section 5-9-6, Earlsboro Pool, made 344 bbls. from Wilcox sand 4,328-48 feet. Mid-Continent Petroleum Corp.'s No. 1 McDaniel, SE cor. SW, Section 7-9-6, has been completed for 590 bbls. in Wilcox sand 4,275-87 feet. Magnolia Petroleum Co.'s No. 3 D. W. Anderson, SE cor. NW SE, Section 18-9-6, East Earlsboro Pool, has been completed for 1,560 bbls. in Wilcox sand 4,308-24 feet. No. 11 A. Anderson, SW cor. NE SW, Section 18-9-6, has been completed for 10 bbls. in Wilcox sand 4,355-60 feet. Gypsy Oil Co. and Devonian Oil Co.'s No. 7 Payne, NE cor. SE SE, Section 18-9-6, made 755 bbls. from Wilcox sand 4,-212-25 feet. Twin State Oil Co.'s No. 3 Judy, CNL S half, Section 6-8-6, Mission Pool, is dry and abandoned at 4,340 feet. Continental Oil Co. and Shaffer Oil & Refining Co.'s No. 5 Harris, SW cor., Section 4-7-7, East Little River Pool, made 300 bbls. at 4,172 feet in Wilcox sand topped at 4,169 feet. No. 6 Harris, NW cor. SW SW, Section 4-7-7, was completed for 680 bbls. in Wilcox sand 4,160-70 feet. Superior Oil Corp. and Magnolia Petroleum Co.'s No. 1 Reed, NE cor. NW NW, Section 9-7-7, is dry and abandoned at 4,278 feet. Pure Oil Co.'s No. 2 Bates, SW cor. SE NE, Section 13-6-7, flowed 1,936 bbls. from Wilcox sand 4,167-81 feet. Sinclair Oil & Gas Co.'s No. 2 Joanna, SW cor. NW, Section 24-5-7, has been completed for 25,000,000 feet of gas at 2,400 feet after it was plugged back from 4,282 feet. The Prairie Oil & Gas Co.'s No. 5 Harris, NW cor. NE SW, Section 14-7-6, Little River Pool, made 25,500,000 feet of gas in Gilcrease sand 3,194-3,201 feet.

Stephens County

Pace & Texhoma Oil Co.'s No. 5 Houston, SE cor. NW SW, Section 2-2s-8w, is drilling at 1,432 feet. No. 6 Houston, NE cor. SW SW, Section 2-2s-8w, is drilling at 150 feet. Ven Mex Oil Co. and Mid-Continent Oil Co. and others made location for No. 1 Howard, SE cor. NW, Section 5-2s-6w. The rig and tools were moved in for No. 1 Andrea, SW cor. NE SE, Section 5-2s-6w. Magnolia Petroleum Co.'s No. 2 Andrea, NE cor. SE NE, Section 8-2s-6w, is rigging up. Wirt Franklin Petroleum Corp.'s No. 2 Brooks, SE cor. NE, Section 8-2s-6w, is a rig going up. Wirt Franklin Petroleum Corp. is erecting the rig for No. 2 Spain, SW cor. NW, Section 9-2s-6w. Location has been made for No. 2 Green, NW cor. SE NW, Section 9-2s-6w. Ellis Drilling Co.'s No. 9 Nigh, SW cor. NW, Section 34-1s-8w, made 12 bbls. in sand 1,685-89 feet. Wirt Franklin Petroleum Corp.'s No. 1 Bonner, NW cor. SE, Section 9-2s-6w, has been abandoned at 3,939 feet. No. 1 Green, NW cor. SW NW, Section 9-2s-6w, has been completed for 550 bbls. in sandy shale 3,166-88 feet.

Tulsa County

The Prairie Oil & Gas Co.'s No. 3 Lewis, C NE SE, Section 34-17-12, has been abandoned at 2,451 feet.

Wagoner County

Mack Drilling Co.'s No. 1 Lovett, C SW SE, Section 25-16-16, has been abandoned at 1,256 feet.

MICHIGAN FIELDS

(Continued from Page 78)

in the lower Traverse at 1,870 feet but will be carried to the Dundee. It swabbed 40 bbls. in about four hours.

Mount Pleasant Field

Wintry weather slowed up drilling operations in the Mount Pleasant Field so that no new completions were reported within the proven field although four Isabella County wildcats were drilled into salt water as dry holes in the Dundee and a fifth was abandoned.

The E. Brown Development Co.'s No. 1 James Brown, NE NE, Section 3-14n-3w, semiwildcat, struck salt water at 3,-643 feet. A good show of oil had been struck in the upper Traverse at 2,915 feet.

Two wells in Section 34-15n-3w, Denver Township, northwest of the proven field, were dry in the Dundee. The Mid-Michigan Development Co.'s No. 1 Marthey, SW NE, Section 34, struck salt water at 3,647 feet and the West Virginia Oil Co.'s No. 1 Dodds, NE NW, Section 34, was dry at about 3,650 feet.

H. E. Pollock's No. 1 Campbell, SW SW, Section 11-16-3, Wise Township, north of the other new dry holes, struck salt water at 3,801 feet.

The Ohio Producing & Refining Co.'s No. 1 Keeler-Weideman, SE NE, Section 35-15n-3w, Denver Township, was abandoned at 962 feet.

The Pure Oil Co., largest operator in the field, has more than half a dozen wells ready to drill into the Dundee which should be completed this week.

New Permits

Three permits were issued to the Pure Oil Co.: No. 3-C Glen M. Reem, SE NW SW, Section 7-14n-2w, Greendale Township, Midland County; No. 2 Arthur N. Ward, NW SE SW, Section 7-14-2; and No. 3 Harkins, SE NE NE, Section 11-14n-3w, Chippewa Township, Isabella County. The Geneva Oil Co. will drill a new wildcat, No. 1 M. V. Warken, SW SE, Section 8-13n-1w, Porter Township, Midland County. The Isabella Oil Development Co., No. 1 Mitchell and Keeler, NW NW, Section 10-16n-6w, Broomfield Township, Isabella County, and J. O. Duryee's No. 1 Johnson and Bullard, SE SW, Section 10-15n-4w, Isabella Township, Isabella County, are new central Michigan wildcats.

The St. Clair Oil & Gas Co.'s No. 1 O. J. Hubbard, SW NE, Section 14-2s-6w, Marshall Township, Calhoun County, near Marshall, is a south central Michigan wildcat.

Gratiot County

Three wildcats in Gratiot County, south of the Mount Pleasant Field, are nearing the Dundee and will soon be drilled into this formation which has been a good producer in Isabella and Midland County wells. The deepest is Samuel M. Bacon's No. 1 J. D. McCallum well, SW NE, Section 6-13n-1w, Wheeler Township. It is a half mile east and 3½ miles north of Breckenridge and is nearest the proven field.

Two other wells are several hundred feet less than the McCallum well in depth. They are Mr. Bacon's No. 1 Gibbs, NE SE, Section 1-10n-1w, Hamilton Township, and the Maeston Oil Co.'s No. 1 Cornwell estate, SW SW, Section 27-12n-1w, Wheeler Township. The Gibbs well is reported to have had a show of oil at about 2,800 feet but not in paying quantities.

Clare County

Although no new wells have come in since the discovery of a considerable flow of gas in James A. McKay's No. 1 fee, NE NW, Section 6-17n-4w, Grant Township, Clare County, this area north of the Mount Pleasant Field has been having a good play on leases.

The Decem Development Co.'s No. 1 F. Salters, NE NE, Section 33-18n-6w, Fremont Township, is drilling below 2,-000 feet. It had several shows in the Marshall, the depth at which the McKay well struck a flow of about 3,000,000 feet of gas.

Ottawa County Deep Test

Natural gas struck about two weeks ago in the Michigan Petroleum Co.'s No. 1 C. E. Moe, SE SE, Section 6-9-13, Chester Township, Ottawa County, near the village of Ravenna, was tested and proved to be a much higher quality than in the Muskegon Field, having a B.t.u. content of more than 1,300, a gasoline content of 1.25, and gasoline gravity of 89. The gas is a sweet gas with no trace of sulphur as found in the Dundee gas in the Muskegon Field. The company estimated it at 100,000 to 250,000 feet. It is expected it will take from 200 to 500 feet more to reach the Trenton limestone in which the operators are hoping to open a new and larger western Michigan pool.

The well is about 20 miles southeast of the proven Muskegon Field and deep pay in the Ravenna well will encourage deep test drilling in the near-by field. The wildcat is now 4,776 feet although gas has been encountered in increasing quantities all through the Cincinnati series for 235 feet above the present depth.

Operators believe they must pass through the Utica shale before reaching the Trenton formation. State geologists estimate they will have at least 200 feet more of drilling.

Buchanan and Frye's No. 1 Fruitvale, SW SE, Section 6-12-16, Blue Lake Township, Muskegon County, has been shut down at 2,205 feet but will be drilled into the Dundee formation. Formations are running higher than in C. J. Sipple's No. 1 Iroquois Trust, SE NW, Section 35-12-17, Grant Township, Oceana County, about 2 miles northwest. Mr. Sipple has cleared location for a new wildcat on another lease of the Iroquois Trust Co., in Section 25-13-17, also Grant Township, Oceana County.

Newaygo County

Only three of 10 uncompleted wildcat wells in Newaygo County are drilling, one above the upper Traverse pay sands and two below.

Although water was struck in the second pay streak in the upper Traverse prospects in the Pennsylvania Oil & Gas Co.'s No. 1 Miller, SE SE, Section 33-14-11, Goodwell, Township, are considered good. It is drilling at about 2,900 feet after having swabbed as much as 40 bbls. from a show in the upper Traverse at 2,797 feet. The Traverse limestone was topped at 2,785 feet and the well was drilled into bottom water but continues to fill up with oil so it is necessary to stop occasionally to bail it out. It will be drilled to the Dundee. Water, oil and gas were struck at 2,802 feet in the second pay.

The Atlantic Exploration Co.'s No. 1 Bridges, NW SW, Section 12-11-13, Ashland Township, had a show in the upper Traverse and is drilling to the Dundee at about 2,500 feet.

GEOLOGICAL RESEARCH

More than a score of leading geologists of the country representing many of the principal universities, technical schools, the United States Geological Survey, geological department of states, and industrial organization laboratories, have combined in an effort to develop a plan whereby the progress in geological research during the past hundred years may be graphically depicted at the Chicago Century of Progress celebration in 1933.

Two scientific groups are working on the plan from the geological standpoint, one a general geology committee under the chairmanship of Dr. W. O. Hotchkiss, president of the Michigan College of Mines and Technology, and the other a committee on economic geology, acting under Prof. Edson S. Bastin of Chicago University.

Among the members of Professor Bastin's committee are George H. Ashley, state geologist of Pennsylvania; Kenneth C. Heald, geologic advisor of the Gulf companies; M. M. Leighton, chief, Illinois State Geological Survey and William E. Wrather, petroleum geologist, Dallas, Tex.

JOHN W. COAST DEAD

John Weston Coast, 71 years, a veteran oil man widely known in the northern district of the Pennsylvania Grade oil field, died in Claremore, Okla., on November 22, after a long illness. He had been receiving treatment in Claremore. His body was found in a hotel room. A heart lesion was given as the cause of death. The body was taken to Olean, N. Y., the former home of Mr. Coast and the funeral and burial were held there.

John Weston Coast's father, John Coast of Olean, was one of the best known oil men in the first two decades of the oil industry. His sons succeeded him in the business and were large producers in the New York State side of the big Bradford Field.

Surviving are one son, J. W. Coast, Jr., of Tulsa, and two daughters.

LOUISIANA-ARKANSAS PROVEN AREAS

(Continued from Page 70)

CADDO PARISH—OIL CITY

Arrow Synd.'s No. 1 Pender, 200 ft. N, 440 ft. E, SW cor., NW NW, Sec. 11-20-15 ..... Tested S.W. 2,231 ft; W.O.

Gulf. Ref. Co.'s No. 21-A Levee Board, 1,126 ft. S. 650 ft. E, NW cor. NE, Sec. 34-21-16 ..... Began drlg. Nov. 21; cm.d. 10-in. 109 ft; drlg. 908 ft.

Magnolia Pet. Co.'s No. 19 Doan-Thigpen, 330 ft. N, 990 ft. W, SE cor., Sec. 6-20-15 ..... Drlg. lime and shale 2,898 ft.

The Texas Co.'s No. 72 Levee Board, 725 ft. N, 210 ft. E, SW cor. SE, Sec. 27-21-16 ..... Rigging up.

J. C. Tippett's No. 1 Levee Board, 1,120 ft. W, 200 f.. N, SE cor. SW, Sec. 26-21-16 ..... S.W. 1,860 ft; plugging back to 1,854 ft.

PINE ISLAND

Double II Oil Co.'s No. 12 Spell, 850 ft. N, 800 ft. W. SE cor. NE, Sec. 15-21-15 ..... Began drlg. Nov. 11; cmtd. 10-in. 42 ft; 6-in. 1,410 ft; bailing to test 1,690 ft.

E. W. McGoldrick's No. 1 Dreyfuss-Lane, 515 ft. N. 300 ft. E, SW cor. NE, Sec. 15-21-15 ..... Cmtd. 10-in. 40 ft; 6-in. 1,510 ft; W.O.S.R; 1,700 ft.

Simplex Oil Co.'s No. 7 Hunsicker, 670 ft. W, 400 ft. S, NE cor. SE, Sec. 15-20-15 ..... W.O.S.R; 2,219 ft.

CLAIBORNE PARISH—HOMER

Oakes et als' No. 1 Richardson, NE SE, Sec. 19-21-17 Reaming to bottom; T.D. 1,700 ft.

LA SALLE PARISH—URANIA

Air Lift Oil Co.'s No. 8-A Hardtner, Sec. 7-10-2e (no check) ..... Drlg. 1,200 ft.

Ark. Fuel Oil Co.'s No. 5 Urania, 200 ft. S, 200 ft. E, NW cor. NE SE, Sec. 24-10-1e ..... Drlg. 2,600 ft.

Gardner, Brown & Harter's No. 1 S. J. Winberry, 400 f.. W, 150 f.. S, NE cor. NW, Sec. 18-10-2e ..... Derrick.

Kinney, Hardtner & Randall's No. 1 Kinney, SW SW. Sec. 7-10-2e ..... S.D. 1,570 ft.

Philp et als' No. 1 Urania, SE cor. NE NE, Sec. 1-10-1e ..... Tested 500,000 ft. gas and sanded up; C.O.; setting liner to test; T.D. 730 ft.

Randall et als' No. 3 Urania, Sec. 1-10-1e ..... S.D. 675 ft.

Trio Oil Co.'s No. 2 Urania, NE cor. SW SW NW, Sec. 19-10-1e ..... Rigging up.

MOREHOUSE PARISH

Bahan & Bahan's No. 2 Feazel, 990 ft. S, 330 ft. W, NE cor., Sec. 3-20-4 ..... Rigging up.

J. S. Herkness' No. 11 Bowles, 4,620 ft. S. 1,980 ft. E. NW cor. Sec. 18-20-5 ..... Set 6-in. 2,157 ft.

J. S. Herkness' No. 12 Bowles, 3,392 ft. E. 3,300 ft. S. NW cor., Sec. 18-20-5 ..... Location.

Magnolia Pet. Co.'s No. 6 U. S. Govt., 490 ft. N, 254 ft. W. SE cor., Lot 2, Sec. 33-21-5 ..... Drlg. 1,670 ft.

Magnolia Pet. Co.'s No. 7 U. S. Gov't., 250 ft. N, 45 ft. W. SW cor. Lot 2, Sec. 33-21-5 ..... Began drlg. Nov. 24; cmtd. 15½-in. 191 ft.

Southern Carbon Co.'s No. 1 U. S. Gov't., 1,840 ft. W. 660 ft. S, NE cor. Sec. 13-20-4 ..... Began drlg. Nov. 20; cmtd. 12-in. 182 ft.; drlg. 1,540 ft.

Southern Carbon Co.'s No. 12 Tensas, 660 f.. S, 660 ft. E, NW cor., Sec. 2-20-4 ..... Drlg. in 2,230 ft.

Southern Carbon Co.'s No. 13 Tensas, 660 ft. S, 1,320 ft. W, NE cor., Sec. 4-20-4 ..... Derrick.

United Carbon Co.'s No. 2 Patton, 660 ft. N, 660 ft. E, SW cor. SE, Sec. 2-20-4 ..... Location.

United Carbon Co.'s No. 3 Patton, 660 ft. W, 660 ft. S, NE cor. SE, Sec. 2-20-4 ..... Location.

OUACHITA PARISH

Amalgamated Carbon Co.'s No. 2 Cole, 742 f.. E, 703 ft. S, NW cor., Sec. 43-19-4 ..... Rigging up.

Austin & Jordan's No. 1 Albright, 1,597 ft. E, 744 ft. N, common cor. Secs. 10, 9 and 13, in Sec. 13-18-3 .. Drlg. shale and boulders 1,930 f..

Chauvin Gas Co.'s No. 2 Slagle Johnson, 3,498 ft. S, 26 ft. E, NW cor., Sec. 49-18-4 ..... Cmtd. 8-in. 929 ft.

Chauvin Gas Co.'s No. 3 Slagle Johnson, 2,539 ft. S, 55 ft. E, NW cor., Sec. 47-18-4 ..... Rigging up.

Chauvin Gas Co.'s No. 4 Slagle Johnson, 4,505 ft. S, 257 ft. E, NW cor. Sec. 47-18-4 ..... Location.

Hope Prod. Co.'s No. 1 Fairbanks, 660 ft. N, 624 ft. E, SW cor. SE, Sec. 25-20-4 ..... Tested 500,000 ft. gas; arranging to deepen 2,160 ft.

Hope Prod. Co.'s No. 2 Fairbanks, 1,876 ft. E, 628 ft. N, SW cor. SE, Sec. 25-20-4 ..... Location.

Hope Prod. Co.'s No. 3 Fairbanks, 1,876 ft. E, 628 ft. S, NW cor. NE, Sec. 36-20-4 ..... Location.

G. E. Jordan's No. 1 Anding, NW NE, Sec. 18-18-5 ..... Plugging back to 2,234 ft; T.D. 2,480 ft.

La. Gas & Fuel Co.'s No. 1 Beard, Sec. 46-18-4 ..... Derrick.

Mack & Pipes' No. 1 Burke est., 654 ft. N, 497 ft. E. SW cor., Sec. 6-18-5 ..... Cmtd. 6-in. 2,170 ft.

Magnolia Pet. Co.'s No. 2 fee 401, 660 ft. S, 660 ft. E. NW cor., Sec. 2-18-3 ..... Derrick.

Magnolia Pet. Co.'s No. 4 U. S., Sec. 20-19-5; reported completed July 31, in error ..... Tested 1,000,000 ft. gas at 515 lbs. rock pressure; set liner 2,528 ft; bailed dry; plugged back to 2,200 ft; estimated 500,000 f.. gas; W.O; waiting orders 2,528 ft.

Michlouzanna O. & G. Dev. Co.'s No. 1 Os erlind, 6,877 ft. S, 819 ft. W, NW cor. irregular Sec. 42-18-4 .... Derrick.

New Process Carbon Co.'s No. 2 Cole, 1,971 f.. E, 1,820 ft. N, SW cor., Sec. 35-20-4 ..... Drlg. 8-in. plug; T.D. 2,115 ft.

Palmer Corp.'s No. 1 Cagle, 1,964 ft. S, 476 ft. E, NW cor., Sec. 7-18-5 ..... Tested S.W. 2,386 ft.; drlg red shale 2,455 ft.

Sho-Van Gas Products Co.'s No. 2 W. Va., 186 ft. N, 67 ft. W, NW cor., Sec. 42, in Sec. 8 ..... Began drlg. Nov. 24; cmtd. 12-in. 168 ft.; 8-in. 820 ft.; drlg 2,000 ft.

Sho-Van Gas Products Co.'s No. 3 W. Va., 1,980 ft. S and W. NE cor., Sec. 8-18-4 ..... Location.

Sho-Van Gas Products Co.'s No. 4 W. Va., 1,078 f. N. 294 ft. W, NE cor., Sec. 49, in Sec. 7 ..... Location.

Sho-Van Gas Products Co.'s No. 5 W. Va., 2,046 ft. S. 1,790 ft. W, NE cor. SE, Sec. 6-18-4 ..... Began drlg. Nov. 26.

Southern Carbon Co.'s No. 14 Fairbanks, Sec. 43-20-4 .. Location.

Southern Carbon Co.'s No. 54 fee, 660 ft. N, 674 ft. W. SE cor. NE, Sec. 13-19-4 ..... Arranging to plug back; T.D. 2,621 ft.

Southern Carbon Co.'s No. 4 Phillips, 660 ft. S, 660 ft. E, NW cor., Sec. 8-19-4 ..... Rigging up.

Trousdale & Wright's No. 2 Kate Cole, 240 ft. W, 1,311 ft. S of point where N line of Sec. 42 joins dividing line of Secs. 8 and 9, in Sec. 42-18-4 ..... Cmtd. 12-in. 825 ft.; 8-in. 1,030 ft.; drlg. gumbo 1,200 ft.

Trousdale & Wright's No. 2 Kate Cole, Sec. 42-18-4e .... Began drlg. Nov. 12; cmtd. 12-in. 385 ft; 8-in. 1,030 ft.

Union Gas Products Co.'s No. 1 Hare, 660 ft. S, 660 ft. W, NE cor. NW, Sec. 22-19-5 ..... Rig up.

United Oil & Nat. Gas Products Co. of La.'s No. 5 Guthrie, 6,896 ft. N, 6,022 ft. W, cor. Secs. 49, 26, and 25, Sec. 49-20-5 ..... Derrick.

United Oil & Nat. Gas Produc.s Co. of La.'s No. 2 Cole, 660 ft. S, 594 ft. E. C. Sec. 26-20-4 ..... Derrick.

United Carbon Co.'s No. 5 Spade, 660 ft. N, 660 ft. W, SE cor. NE Sec. 35-19-3 ..... Location.

W. Va. O. & G. Co.'s No. 9 W. Va.. 1,980 ft. E, 1,320 ft. S, NW cor. SW, Sec. 5-18-4 ..... Drlg. shale and boulders 1,900 ft.

RED RIVER PARISH

Joe Danciger et als' No. 1 Pickett, 6,621 ft. S, 2,623 ft. W, NE cor., Sec. 15-13-11, in Sec. 23-13-11 ..... C.O. 2,400 ft; T.D. 2,555 ft.

Root Refineries, Inc.'s No. 1 Home State & Savings Bank, 330 ft. N, 330 ft. W, C, Sec. 8-13-10 ..... Oil show 2,570 ft; drill stem tes:; S.W; cored sand showing gas 2,598 ft; S D. 2,667 ft.

Triple Oil Co.'s No. 1 W. M. Pollock, Sec. 33-13-11 ..... Cmtd. 6⅝-in. 2,456 ft; W.O.S.R; 2,470 ft.

RICHLAND PARISH

W. C. Feazell's No. 1 R. B. Simon, 2,406 f.. W, 2,020 ft. S, NE cor., Sec. 11-16-6 ..... Rig up.

W. C. Feazell's No. 1 E. L. Wilson, 647 ft. N, 241 ft. E, SW cor. NW, Sec. 31-16-6 ..... Drlg. gumbo 350 ft.

Industrial Gas Co.'s No. 1 Boughton, N 85 deg., 10 min. W, 4,458 ft., 865 ft. S, NE cor., Sec. 1-16-6 ..... Fishing for bit and collar; T.D. 1,888 ft

Industrial Gas Co.'s No. 1-A J. H. Hemler, 1,431 ft. E, 660 ft. S, NW cor., Sec. 12-16-6 ..... Cmtd 6-in. 2,300 ft.

Industrial Gas Co.'s No. 1 Rayville State Bank, 660 ft. N, 660 ft. E, C, Sec. 12-16-6 ..... Cmtd. 6-in. 2,300 ft.

Industrial Gas Co.'s No. 1-C Sartor, 536 ft. N, 1,333 ft. E, SW cor., Sec. 21-16-6 ..... Cmtd. gas blowout 235 ft.

International Gas Products Co.'s No. 1 Boughton, Sec. 33-16-6 ..... Drlg. 6-in. plug; T.D. 2,280 ft.

Magnolia Pet. Co.'s No. 4 C. M. Noble, 400 ft. S, 660 ft. W, NE cor. SE NE, Sec. 35-16-5 ..... Location.

M. L. Meredith's No. 1 Holdness, 1,980 ft. S, 990 ft. W, NE cor., Sec. 15-16-6 ..... Cmtd. 12-in. 203 ft.

Northern La. Nat. Gas Co.'s No. 1-A Colvin, 1,320 ft. E, 370 f.. S, C, Sec. 34-17-6 ..... Cmtd. 6-in. 2,300 ft.

Northern La. Nat. Gas Co.'s No. 1 Pipes, 2,433 ft. S. 581 ft. E, C, Sec. 34-17-6 ..... Cmtd. 6-in. 2,300 ft.

Northern La. Nat. Gas Co.'s No. 1 A. Purvis, 1,282 ft. S, 183 ft. E, C, Sec. 34-17-6 ..... Cmtd. 6-in. 2,300 ft.

Northern La. Nat. Gas Co.'s No. 1 C. M. Purvis, 1,821 ft. E, 630 ft. S, NW cor. SE NW, Sec. 3-16-6 ..... Cmtd. 6-in. 2,300 ft.

Palmer Corp.'s No. 2 Earle, 1,980 ft. N, 1,320 ft. W, SE cor., Sec. 31-17-6 ..... Cmtd. 6-in. 2,300 ft.

Palmer Corp.'s No. 1 Eubanks, 1,100 ft. N, 350 ft. E, SW cor. SE NW, Sec. 26-17-6 ..... Cored red beds and lime 2,970 ft.

Palmer Corp's No. 5 Rhymes, 1,386 ft. N, 599 ft. E, SW cor. Sec. 34-17-6 ..... Rigging up.

Southern Carbon Co.'s No. 1 S. R. Humble, 600 f.. N, 600 ft. W, SE cor., Sec. 26-16-6 ..... Drill stem stuck 2,325 ft.

Richland Production Co.'s No. 1 Brown, Sec. 1-16-6 .. Began drlg. Nov. 24; drlg 130 fr.

United Carbon Co.'s No. 1 Roberts, 1,650 ft. N, 600 ft. W, SE cor., Sec. 21-16-6 ..... Drlg. shale and boulders 1,830 ft.

SABINE PARISH—PLEASANT HILL

Bridges-Clark Oil Co.'s No. 3 Williams, 1,780 ft. N. 2,180 ft. E, SW cor., Sec. 33-10-12 ..... Began drlg. Nov. 12; cmtd. 10-in. 102 ft; drlg. 1,670 ft.

Magnolia Pet. Co.'s No. 5 E. E. Hall, 350 ft. N, 312 ft. E, SW cor. NW SW, Sec. 33-10-12 ..... Location.

Reid Clark et als' No. 2 Moore, 1,600 ft. N, 330 ft. W, SE cor., Sec. 32-10-12 ..... Began drlg. Nov. 7; cmtd. 10-in. 104 ft; drlg. 2,470 ft.

UNION PARISH

Bahan & Bahan's No. 1 Bess, 47 ft. S, 64 ft. W. NE cor. NW, Sec. 11-20-3 ..... S D. 130 ft.

Bahan & Bahan's No. 2 J. J. Parks, 1,119 ft. W, 375 ft. S, NE cor. SE. Sec. 2-20-3, (second hole) ..... Cmtd. 6-in. 2,090 ft.

J. R. Bahan's No. 1 fee, 876 ft. W. 145 ft. S, NE cor. NW, Sec. 11-20-3 ..... Location.

E. S. Hall's No. 2 Spencer, 317 ft. W, 182 ft. S. NE cor. NW SE, Sec. 2-20-3 ..... Drlg. in; 2,078 ft.

Interstate Nat. Gas Co.'s No. 23 fee, 660 ft. S, 660 ft. E, NW cor., Sec. 33-20-3 ..... Drlg. 1,820 ft.

Lyons Gas Co.'s No. 1 A. B. Edwards, 722 ft. W, 897 ft. S, NE cor. NW, Sec. 11-20-3 ..... Derrick.

WEBSTER PARISH—COTTON VALLEY

Magnolia Pet. Co.'s No. 1 McCook & Hibbler, C SW SW, Sec. 22-21-10 ..... Tested hot S.W., show of oil 8-f.. sand; T.D. 6,965 ft.

Ohio Oil Co.'s No. 46 Bodcaw, 660 ft. N, 660 ft. E. SW cor. SW NW, Sec. 28-21-10 ..... Derrick.

Palmer Corp.'s No. 2 Miller, 520 ft. N, 504 ft. E. SW cor. SW, Sec. 28-21-10 ..... Drlg. lime 3,941 ft.

Standard Oil Co.'s No. 3 Bodcaw, 660 ft. N, 660 ft. E, SW cor. SE NE, Sec. 28-21-10 ..... Completed Nov. 11; 500,000 ft. gas 4,700 ft.

Standard Oil Co.'s No. 1-E Bodcaw, 660 ft. N, 660 ft. E, SW cor. SE, Sec. 28-21-10 ..... Began drlg. Nov. 23; cmtd. 12½-in. 496 ft.

Standard Oil Co.'s No. 1 Thos. Crichton et al, 660 ft. S, 660 ft. W, NE cor. NW, Sec. 22-21-10 ..... Drlg. gummy shale 3,700 ft.

WEBSTER PARISH—SAREPTA AND SHONGALOO

Donohoe O. & G. Co.'s No. 1-B W. B. Roseberry, 250 ft. S, 250 ft. E. C, Sec. 19-23-9 ..... Began drlg Nov. 25; S.D. 104 ft.

Pat Hudson's No. 1 L. S. Gardner, 150 ft. E, 200 ft. S, NW cor. SW NE, Sec. 1-22-11 ..... W.O.S.R; 1,500 ft. oil; 6-ft. sand; T.D. 2,743 ft.

Pat Hudson's No. 2 S. Gardner, 330 ft. N, 300 ft. E, C, Sec. 1-22-11 ..... Drilling.

Pat Hudson's No. 1 H. L. Slack, 330 ft. W, 330 ft. N, SE cor. SW, Sec. 36-23-11 ..... Location.

F. E. Estes' No. 2 Pardee, 1,270 ft. W, 50 ft. S, NE cor. NW, Sec. 3-22-11 ..... Coring 2,656 ft.

Jones and others' No. 1 J. E. Womble, Sec. 1-22-11 ..... Began drlg. Nov. 22; cmtd. 10-in. 200 ft.; drlg. 900 ft.

Magnolia Pet. Co.'s No. 1 C. O. Bailey, 100 ft. N, 660 ft. E, SW cor. NW NE, Sec. 29-23-9 ..... Tested dry; T.D. 2,758 ft; W.O.

Sarepta Oil Co.'s No. 1 L. S. Gardner, 300 ft. S, 300 ft. W, C, Sec. 1-22-11 ..... Did not abd; moving in heavier rig; T.D. 2,681 ft.

ARKANSAS

JOHNSON COUNTY—CLARKSVILLE

Ark.-La. P. L. Co.'s No. 1 Patterson, 1,020 ft. S, 2,570 ft. E, NW cor., Sec. 14-10-24 ..... Rigging up.

NEVADA COUNTY

Roy Davis et als' No. 1 Chas. Henry, 1,120 ft. N, 1,120 ft. W, SE cor., Sec. 10-12-20 ..... Derrick.

C. F. Steele's No. 1 E. W. Groves, Sec. 21-14-20 ..... Shut down.

OUACHITA COUNTY—SMACKOVER

J. E. Crosbie's No. 4 H. Primm, 300 ft. W, 250 ft. N, SE cor., Sec. 23-15-16 ..... Set liner 2,040 ft; W.O.S.R.

J. E. Crosbie's No. 8 Robertson, 250 ft. S, 200 ft. W, NE cor. SW NW Sec. 25-15-16 ..... Derrick.

L. H. Hamilton's No. 1 Arnold & Doyle, SE SE, Sec. 23-15-16 ..... Set liner 2,012 ft.; W.O.

Marine Oil Co.'s No. 7-A Hays, Sec. 4-16-15 ..... W.O.S.R; 450 ft. oil; 20-ft. sand; T.D. 2,362 ft.

Oil Field Corp.'s No. 10 McKenzie, 265 ft. E. 185 ft. N, SW cor. SE NE, Sec. 36-15-16 ..... W.O.S.R; 2,002 ft.

Phillips Pet. Co.'s No. 3 Clayton, NE cor. NW NE, Sec. 34-15-15 ..... W.O.S.R; 350 ft. fluid in hole; 37-ft. broken sand; T.D. 2,036 ft.

Simms Oil Co.'s No. 5 Johnson, 301 ft. N. 250 ft. W. SE cor. NE SE, Sec. 34-15-15 ..... Began drlg Nov. 23; cmtd. 10-in. 63 ft.

Southern Prod. Co.'s No. 1-A Watts, SW cor. SW SE, Sec. 27-15-15 ..... Cmtd. 6⅝-in. 2,029 ft; T.D. 2,034 ft; W.O.S.R; 2,052 ft.

Southern Prod. Co.'s No. 2-A Watts, NW cor. SW SE, Sec. 27-15-15 ..... Began drlg. Nov. 21; drlg. 180 ft.

Standard Oil Co.'s No. 13 Arnold, 200 ft. S, 200 ft. E. NW cor. NE NE, Sec. 26-15-16 ..... Drlg. 100 ft.

Standard Oil Co.'s No. 9 Powell, Sec. 34-15-15 ..... Pumped 5 bbls.; T.D. 2,000 ft.; arranging to deepen.

J. D. Wingfield's No. 1 Martin, SW cor., Sec. 26-15-15... Set 6⅝-in. 2,085 ft; tested little oil and S.W; W.O; T.D. 2,115 ft.

OUACHITA COUNTY—STEPHENS

La. Oil Ref. Corp.'s No. 1 Green, 330 ft. S, 330 ft. E, NW cor., Sec. 22-15-19 ... Cmtd. 6⅝-in. 2,494 ft.

UNION COUNTY—CHAMPAGNOLLE

Magnolia Pet. Co.'s No. 1 Schmidt, 300 ft. N, 300 ft. W, SE cor. NW SW, Sec. 5-17-14 ... Plugged back to 2,718 ft.; T.D. 3,226 ft.

UNION COUNTY EL DORADO

O. W. Estes' No. 1 Telford, 320 ft. S, 320 f., E, NW cor. SW Sec. 35-17-15 ... Derrick.

Rice et als' No. 1 W. Ralty, 150 ft. S, 150 ft. E, NW cor. SW, Sec. 7-17-15 ... Spudded July 18; cmtd. 10-in. at 92 ft.

Wilson & Chapman's No. 1 Thompson, 150 ft. N, 330 ft. W, SE cor. NW NW, Sec. 4-17-15 ... Began drlg. Nov. 16; cmtd. 10-in. 110 ft.

UNION COUNTY—SMACKOVER

Ark. Fuel Oil Co.'s No. 5 Alphin, Sec. 11-16-16 ... O.W.D.D; perforated csg. 1,960-70 ft; swbd. dry; filled up 40 ft. oil in hour; W.O.

Foster et als' No. 1 J. V. Spahr, 330 ft. S, 330 ft. W, NE cor. SE SW, Sec. 35-15-16 ... Rig up.

E. M. Jones' No. 1 H. Murphy, 211 ft. S, 211 ft. E, NW cor. Lot 3, NW, Sec. 2-16-15 ... W.O.S.R; 90 ft. fluid in hole; 17-ft. broken sand; T.D. 1,981 ft.

Lion Oil Ref. Co.'s No. 1 James, CWL, Lot 2, NW, Sec. 6-16-15 ... Cmtd. 6⅝-in. 1,942 ft; drlg. in; bailing to test 58-ft. broken sand; pumping S.W. 2,018 ft.

Root Refineries, Inc.'s No. 8 Calloway, 510 ft. S, 150 ft. W, NE cor., Sec. 4-16-15 ... Coring 1,900 ft.

Skelly Oil Co.'s No. 8-A Alphin, 1,320 ft. S, C, Sec. 24-16-16 ... W.O.S.R. 2,116 ft.

EAST TEXAS

PANOLA COUNTY

Ark.-La. P. L. Co.'s No. 3 Crenshaw, E. F. Mitcheson Sur. Drlg. 1,960 ft.

Ark.-La. P. L. Co.'s No. 8 Warner, Jas. Matthews Sur... Began drlg. Nov. 21; cmtd. 10-in. 60 ft.; drlg. 400 ft.

Ark.-La. P. L. Co.'s No. 10 Werner, 250 ft. S, 132 ft. W, NE cor. 15-acre Werner tract in E. S. Mitcheson Sur. ... Derrick.

S. H. Gardner's No. 5 Brumble, 5,966 ft. E, 4,132 ft. S, NW cor. B. C. Jordan Sur. ... S.D. for wtr; T.D. 1,000 ft.

S. H. Gardner's No. 4 Roquemore, 5,176 ft. E, 4,432 ft. S, NW cor. B. C. Jordan Sur. ... Rigging up.

Magnolia Pet. Co.'s No. 1 M. Jernigan, 330 ft. N, 330 ft. W, SE cor. M. Jerigan tract in Jane Thorpe Sur... Cmtd. 13⅜-in. 156 ft.; drlg. 1,180 ft.

Magnolia Pet. Co.'s No. 1 D. W. Scott, 640 ft. N, 660 ft. E, SW cor. Scott tract in S. Lawless Sur. ... Drlg. sandy shale 2,863 ft.

Magnolia Pet. Co.'s No. 5 G. C. Tiller, 1,114 ft. W, 303 ft. N, SE cor. Jane Thorpe Sur. ... Arranging deep sand test at 2,879 ft.

Magnolia Pet. Co.'s No. 6 G. C. Tiller, 393 ft. S, 1,990 ft. E, NW cor. Jane Thorpe Sur. ... Location.

Nat. Gas Prod. Co.'s No. 10 Roquemore, B. C. Jordan Sur. ... Began drlg. Oct. 20; cmtd. 10-in. 42 ft.

Nat. Gas Prod. Co.'s No. 11 Roquemore, B. C. Jordan Sur. ... Drlg. 650 ft.

Nemours Corp.'s No. 6 G. C. Tiller, 2,330 ft. S, 300 ft. W, NE cor. W. D. Matthews Sur. ... Drlg. 2,150 ft.

The Texas Co.'s No. 8 G. W. Brumble, 1,085 ft. E, 330 ft. N, SW cor. John Womack Sur. ... Began drlg. Nov. 20; cmtd. 10-in. 55 ft.; drlg. 1,024 ft.

WILDCAT OPERATIONS IN LOUISIANA-ARKANSAS

(Continued from Page 70)

Longstreet Synd.'s No. 1 Ramsey, NE cor. SW NE, Sec. 33-13-16 ... Changing to heavy rig and arranging to side.rack; T.D. 2,302 ft.

Magnolia Pet. Co.'s No. 1 Anna Mason, 990 ft. S, 990 ft. E, NW cor. SW Sec. 27-12-11 ... Arranging for D.S. test 2,746 ft.

R. O. Roy's No. 1-B Farmer, 660 ft. S, 660 ft. E, NE SW, Sec. 8-13-13 ... Location.

R. O. Roy's No. 1-E Farmer, 660 ft. S, 660 ft. W, NE cor. NW, Sec. 5-13-13 ... Location.

FRANKLIN PARISH

Davis et als' No. 1 Moore, 600 ft. W, 200 ft. S, NE cor. Sec. 12-11-6 ... S.D. 1,430 ft.

Franklin Oil & Gas Co.'s No. 1 T. J. O'Brien, 300 ft. N, 300 ft. E, SW cor. NW Sec. 17-15-9 ... Cmtd. 15½-in. 208 ft.

LA SALLE PARISH—WHITE SULPHUR DISTRICT

Tunica Pet. Co.'s No. 52 L. & A., 660 ft. N, 660 ft. W, SE cor., Sec. 17-7-2e ... Derrick.

MOREHOUSE PARISH

J. P. White's No. 1 Chess-Wymond, Sec. 32-19-6 ... Tested S.W. 3,025 ft.; W.O.

Rainbow Oil Co.'s No. 1 Louisville Cooperage Co., 990 ft. S and E, NW cor. NE Sec. 33-22-8 ... Derrick.

NATCHITOCHES PARISH

S. D. McDaniel's No. 2 Clark & Morse, 800 ft. E, 350 ft. N, C. Sec. 23-5-6 ... Tested 1,000,000 ft. gas and S.W. 8 ft.; S.D. for orders; T.D. 2,536 ft.

Nichols & Wilder's No. 1 Clark, 150 ft. W, 250 ft. N, SE cor. Sec. 10-10-8 ... Began drlg. Oct. 28; cmtd. 10-in. 205 ft; drlg. chalky lime 2,000 ft.

Robeline O. & G. Co.'s No. 1 Winn, Sec. 7-8-9 ... Rigging up.

OUACHITA PARISH

J. L. Bullock, trustee's No. 1 West Va. Lbr. Co. N½ NE, Sec. 25-18-5 ... Cmtd. 9-in. 2,303 ft; drlg. 2,338 ft.

RAPIDES PARISH

Ayers Bros.' No. 1 Wickliff, 2,790 ft. N, 150 ft. E, SW cor. Sec. 9-5n-2e ... S.D. for water; T.D. 900 ft.

RED RIVER PARISH

W. D. Ball's No. 1 Krumholtz, 660 ft. S, 660 ft. S, NW cor. Sec. 32-14-10 ... S.D. waiting orders 950 ft.

Benedum & Trees Oil Co.'s No. 1 Franklin Realty Co. 350 ft. E, 350 ft. S, NW cor. Sec. 29-11-9 ... Coring 3,739 ft.

Eylers O. & G. Co.'s No. 4 Chaffraix, 150 ft. S, 170 ft. W, NE cor. SW SE Sec. 30-12-10 ... S.D. 2,750 ft.

Eylers O. & G. Co.'s No. 1 Johnson, 500 ft. N, 500 ft. W, SE cor. SW Sec. 17-12-10 ... Set 10-in. 203 ft.; S.D. 1,050 ft.

LeGrande et als' No. 1 Sample, Sec. 11-14-11 ... Rigging up.

D. H. Riddick's No. 1 Johnson, 500 ft. N, 500 ft. W, SE cor. Sec. 17-12-10 ... S.D. 1,050 ft.; laying gas line.

RICHLAND PARISH

J. T. Austin's No. 1 Singleterry, 1,980 ft. N, 660 ft. W, SE cor. Sec. 20-18-7 ... S.D. 100 ft.

Austin & McDonald's No. 1 Hunt, 594 ft. N, 660 ft. E, SW cor Section 13-17-5 ... Derrick.

Austin & McDonald's No. 2 Millsaps, SW cor. Sec. 17-17-6. Waiting orders; T.D. 2,679 ft.

Austin & McDonald's No. 3 Millsaps, 1,980 ft. S, 660 ft. E, NW cor. Sec. 16-17-6 ... Tested S.W.; W.O. 2,477 ft.

Austin & McDonald's No. 4 Millsaps, NW cor. Sec. 16-7-6.. Location.

Austin & McDonald's No. 5 Millsaps, 2,640 ft. N, 1,320 ft. W, SE cor. Sec. 8-17-6 ... Derrick.

W. C. Feezel's No. 1 Landrum, 620 ft. N, 4,573 ft. E, SW cor. Sec. 6-16-7 ... Derrick.

Industrial Gas Co.'s No. 1 T. R. Hodge, 3,259 ft. E, 1,320 ft. S, C, Sec. 7-16-7 ... Cmtd. 6-in. 2,300 ft.

Industrial Gas Co.'s No. 1 A. T. Davidson, 1,856 ft S, 916 ft. E, NW cor. Sec. 6-16-7 ... Cmtd. 6-in. 2,300 ft.

Industrial Gas Co.'s No. 1-A Jack Davidson, N 1degree W, 1,094 ft. S, 2,501 ft. E, NW cor. Sec. 6-16-7 ... Cmtd. 6-in. 2,300 ft.

Industrial Gas Co.'s No. 1 Rus.on Drlg. Co., 1,980 ft. S, 1,955 ft. E, NW cor. Sec. 7-16-7 ... Drlg. shale and boulders 2,280 ft.

Palmer Corp.'s No. 2 Miles, 723 ft. E, 660 ft. S, NW cor. NE, Sec. 12-17-6 ... Cmtd. 6-in. 2,315 ft.

Shreveport Contractors, Inc.,s No. 1 Buie, 600 ft. E, 400 ft. N, SW cor. Sec. 17-15-7 ... O.W.O.D.; dry and abd. 1,946 ft. by Wilson and others; arranging cmt. 6-in. to test gas show 2,361 ft.

Triangle Drlg. Co. and Woodley Pet. Co.'s No. 1 G. L. Cumpton, 660 ft. S, 660 ft. W, NE cor. NW SE, Sec. 16-17-7 ... Did not cmt. 9-in. 1,000 ft; drlg. 2,217 ft.

Woodley Pet. Co.'s No. 1 Buie, 660 ft. N, 1,980 ft. E, SW cor. Sec. 32-18-7 ... Cmtd. 9-in. 953 ft; drlg. 1,350 ft.

SABINE PARISH

R. L. Gay's No. 5 Bowman-Hicks, 1,120 ft. W, 920 ft. N, SE cor. Sec. 14-7-14 ... Bailing; S.O. 2,586 ft.

R. L. Gay, trustee's No. 1 Long-Bell Lbr. Co., NE cor. NW NW Sec. 26-8-14 ... S.D. 3,604 ft.

R. L. Gay, trustee's No. 2 Sabine Lbr. Co., Sec. 23-7-14.. Reaming to bottom; T.D. 3,795 ft.

G. M. LeGrand's No. 1 A. C. Haley, 1,020 ft., 3,300 ft. E, NW cor. Sec. 6-7-12 ... Derrick.

D. H. Riddick's No. 1 Scretchfield, 400 ft. E, 400 ft. N, SW cor. NW SE Sec. 18-9-12 ... Rigging up.

Sabine O. & G. Co.'s No. 1 Anderson, 200 ft. N, 200 ft. E SW cor. SW NW Sec. 19-18-13 ... S.D. 2,100 ft.

A. H. Trevor's No. 1 Long-Bell, 330 ft. S, 330 ft. E, NW cor. SW NW Sec. 29-8-13 ... Tested dry; small show oil and gas W.O.; 3,625 ft.

UNION PARISH

Fred Stovall's No. 1 Stovall, 1,820 ft. E, 350 ft. N, SW cor. Sec. 32-23-4 ... Rig up.

WEBSTER PARISH

F. M. Fuller's No. 1 Monzingo, 200 ft. N, 200 ft. W, SE cor. Sec. 27-18-8 ... Began drlg. Nov. 10; cmtd. 10-in. at 62 ft.

Paul C. Warren et als' No. 1 Martin, 305 ft. N, 212 ft. E, SW cor. Sec. 20-20-9 ... Drlg. 950 ft.

ARKANSAS

ASHLEY COUNTY

Ark. Fuel Oil Co.'s No. 1 Crossett Lbr. Co., 330 ft. E, 330 ft. S, NW cor. Sec. 1-19-7 ... Began drlg. Nov. 21; drlg. 210 ft.

J. G. Marcum, trustee's No. 1 McGarry, 300 ft. W, 100 ft. S, C Sec. 9-19-4 ... Tested dry 3,300 ft.; W.O.

CLARK COUNTY

Wm. Henry, trustee's No. 1 Clark, Sec. 34-9-21 ... S.D. 1,200 ft.

CLEBURN COUNTY

Cosden Oil Co.'s of Ark.'s No. 1 Donophan, 100 ft. S, 660 ft. E, NW cor. SW SE Sec. 19-9-10 ... Fishing for tools; T.D. 320 ft.

DREW COUNTY

McClintock & Goodka's No. 1 Ogles, 920 ft. W, 400 ft. S, NE cor., Sec. 35-13-5 ... O.W.D.D; rptd. junked and abd. at 2,575 ft. Aug. 30, 1928; resumed drlg. Nov. 15, 1929; pulled 1,740 ft. drill stem; milling out of csg. at 1,740 ft.

FAULKNER COUNTY

Gold Creek Oil & Gas Co.'s No. 2 Stermer, SE cor. NW SE Sec. 17-4-13 ... Rigging up.

GARLAND COUNTY

Givens et als' No. 1 Garrett, 660 ft. S, 660 ft. W, C Sec. 1-3-19 ... Began drlg. Aug. 10, 1926; hard sand 3,168-96 ft.; claims show gas; drlg.

GRANT COUNTY

Jones & Watkins' No. 1 Meek, Sec. 5-4-11 ... S.D. 1,400 ft.

LITTLE RIVER COUNTY

A. L. Buck's No. 1 Greason, NW NW, Sec. 25-12-32 ... Drlg. 1,886 ft.

McDonald & Shaw's No. 1 W. E. Black, 240 ft. N, 450 ft. W, SE cor. SE NE Sec. 12-13-28 ... Drlg. 1,550 ft.

MADISON COUNTY

Phillips Pet. Co. and F. S. Craver's No. 1, C Sec. 11-14-23. Tested 250,000 ft. gas 63 ft; S.D.

OUACHITA COUNTY

Artex Oil Co.'s No. 1 M. V. Smith, 330 ft. S, 330 ft. E, NW cor. SE NW, Sec. 31-15-17 ... Began drlg. Nov. 23; cmtd. 10-in. 104 ft.

Copenhaven et als' No. 1 Warnick, Sec. 2-15-17 ... S.D. 2,190 ft.

C. H. McDonald's No. 1 Fogle, Sec. 13-14-16 ... S.D. 2,301 ft.; W.O.

Kobler & Erickson's No. 1 Rumph & Tyson, 300 ft. N, 300 ft. W, SE cor. Sec. 13-15-15 ... Set 10-in. at 98 ft.

Pure Oil Co.'s No. 1 A. A. Wilson, 330 ft. N, 330 ft. W, SE cor. NW SW Sec. 26-15-18 ... Began drlg. Nov. 13; cmtd. 12½-in. 152 ft; drlg. 980 ft.

Wesson et als' No. 1 Booth, Sec. 12-15-19 ... S.D. 2,203 ft.

PIKE COUNTY

Theo. Davis, trustee's No. 1 Ruth Wilson, 200 ft. S, 200 ft. W, NE cor., Sec. 25-5-26 ... Cmtd. 12½-in. 165 ft; drlg. 700 ft; O.W.D.D; abd. by Ark. Manganese Co. as junked at 625 ft. Mar. 21, 1928.

POPE COUNTY

Cosden Oil Co.'s No. 1 Mo. Pac. R.R., 660 ft. N, 660 ft. E, SW cor. NW SE Sec. 13-9-9 ... Began drlg. Nov. 11; S.D; repairing rig 270 ft.

M. W. Greeson's No. 1 C. S. Parke, 330 ft. N, 330 ft. W, SE cor. Sec. 21-8-24 ... Location.

PRAIRIE COUNTY

Transcontinental Oil Co.'s No. 1 Louis Novak, 330 ft. E, 330 ft. N, SW cor. SW NE, Sec. 36-2n-6 ... Top Paleozics 2,273 ft; drlg. 2,280 ft.

ST. FRANCIS COUNTY

Brownlee Drlg. Co.'s No. 1 Whitted, 110 ft. N, 110 ft. E, SW cor. SE NW Sec. 28-4-1 ... Began drlg. Nov. 20; drlg. 295 ft.

UNION COUNTY

Addie & Modisette's No. 1 Union Sawmill, SW cor. SW SE Sec. 25-19-12 ... Location.

Sam Arrendale's No. 1 Gallagher & Nelson, 200 ft. N and W, SE cor. Lot 5, Sec. 18-18-17 ... S.D. 2,268 ft.

W. M. Coates, trustee's No. 1 McDuffie, Sec. 32-19-17 .... Tested salt water 4,071 ft.; W.O.

O. W. Estes' No. 1 Felsenthal, 330 ft. S, 330 ft. W, NE cor. NE NW Sec. 2-18-15 ... S.D.; W.O. 125 ft. oil and S.W. in hole; T.D. 2,191 ft.

Federal Pet. Co.'s No. 1 Union Sawmill fee, NW cor. NE SW Sec. 5-17-12 ... Drlg. red shale 3,256 ft.

Joe Modisette et als' No. 2 Union Sawmill, 1,620 ft. W, 1,020 ft S, NE cor., Sec. 14-18-14 ... Derrick.

Oil Well Corp.'s No. 1 Union Sawmill, 150 ft. S, 150 ft. E, NW cor., Sec. 10-19-14 ... Location.

Stark et als' No. 1 Ainsworth, NE cor. NW NE NE, Sec. 8-19-16 ... Drlg. gumbo 1,602 ft.

T. J. Woodley's No. 1 First Natl. Bank, NW cor. Sec. 34-19-18 ... Derrick.

VAN BUREN COUNTY

Glenn Cole et als, trustee's No. 1 Scanlan, 200 ft. S, 200 ft. W, NE cor. SE NW Sec. 5-19-13 ... S.D. 50 ft.

WASHINGTON COUNTY

O'Hara & Shetterly's No. 1 Boyd, SE cor. SE NE, Sec 12-16-32 ... Spudded Sept. 1928; S.D. 140 ft.; resumed drlg. Aug. 25; U.R.; T.D. 150 ft.

C. H. Willoughby's No. 1 Jones, Sec. 34-16-30 ... Drlg. 1,640 ft.

Lincoln Leaseholding Synd.'s No. 1 Lincoln, Sec. 30-15-32 ... S.D. 1,500 ft.

WHITE COUNTY

Letona Synd.'s No. 1 Letona, SE cor. NW SW Sec. 35-9-8. Cmtng. 5 3/16-in. 3,500 ft; S.D.

EAST TEXAS

CAMP COUNTY

Rogers et als' No. 1 Enfelt, R. M. Montgomery Sur. Tested dry 1,870 ft.; S.D.. 1,920 ft.

RED RIVER COUNTY

D. M. Buffington's No. 1 Hossier, E. Hughhart Sur. Drlg. 2,050 ft.
Shad Harper's No. 1 W. R. Garland, J. Wagley Sur. S.D. 1,862 ft.
Johnson Pet. Co.'s No. 2 Randolph, Edward Dean Sur. S.D. 2,000 ft.

SHELBY COUNTY

Benedum & Trees Oil Co.'s No. 1 Pickering Lbr. Co. 300 ft. S, 300 ft. W, NE cor. Lot 20, D.T.F. Lordt Sur. Setting 8-in. 2,862 ft.
Chapperall Oil Co.'s No. 2 Holt, Matthew Moore Sur. S.D. for orders 3,004 ft.
Gulf Ref. Co.'s No. 2 Pickering, 463 ft. S, 29 ft. W, SW cor. P. W. Harvey Sur. in J. H. Patterson Sur. Cored hard gray lime and shale 3,439 ft.

MISSISSIPPI

ALCORN COUNTY

Alcorn Pet. Co.'s No. 1 Matthews, SE cor. Sec. 14-2s-7e. Drlg. 2,700 ft.

CHICKASAW COUNTY

Hightower & Golson's No. 1 Flemming, NE cor. Sec. 20-13-3 Quicksand 1,240 ft.

HINDS COUNTY

Harry Gerson's No. 1 Edward House, Blk. 16, West Jackson Subd., City of Jackson, in Twp. 5n, Range 1e Rig up.
Oscar Brown's No. 1 Riverside (formerly Hennessee et als') SE cor. SE SW Sec. 23-16-5 Set 12½-in. 30 ft.; S.D. 1,050 ft.
Mrs. Reeder et als' No. 1 State, SE cor. NW NW Sec. 25-6-1e S.D. 2,395 ft.
South Christian Institute's No. 1 fee, SE SW Sec. 29-6-4. Waiting on csg. to set; T.D. 1,203 ft.

HUMPHREYS COUNTY

E. C. Steele et als' No. 1 C. B. Box, SE cor. SE NE Sec. 25-14-4w Set 12½-in. 60 ft.; S.D.

LAUDERDALE COUNTY

Lauderdale O. & G. Co.'s No. 1 Lackey, 990 ft. S and E, NW cor. NE Sec. 2-7-16 Cored sand, shale and gumbo 2,494-2,500 ft.; S.D. 2,786 ft.
Meridian O. & G. Co.'s No. 1 Hauser, Sec. 33-8-18 S.D.; gumbo 2,410 ft.
J. R. Smith Oil Co.'s No. 1 C. F. Craig, Sec. 2-6-14. Derrick.

LAFAYETTE COUNTY

Banks-Goode et als' No. 1 May, 113½ rods S, 26 rods E, NW cor. SW Sec. 22-10-1w Derrick.

LINCOLN COUNTY

La.-Miss Oil Co.'s No. 1 Pat Case, NE NE Sec. 21-8-6. Spudded Feb. 17, 1929; S.D. 50 ft.; resumed drlg. Aug. 12; cm.d. 12½-in. 368 ft.; S.D. salt water sand 1,213 ft.

MONROE COUNTY

Amory Dev. Co.'s No. 1 Bourland, Sec. 2-13-19 S.D.; waiting for 5 3/16-in. csg. 2,580 ft.
Amory Pet. Co.'s No. 1 Hall, Sec. 8-13-19 Fish. for liner and tools 3,045 ft.
Park Bowser et als' No. 1 Cowart, second hole, Sec. 2-12-19 S.D. 30 ft.

RANKIN COUNTY

Home Oil Prod. Co.'s No. 1 E. P. Rainey, NW NW Sec. 13-5-1e Claim show gas 2,912 ft.; recmtd. 10-in. casing for test.

WARREN COUNTY

El Dorado Oil Co.'s No. 1 Dornbush, Sec. 8-18-5 Drlg. 2,400 ft.

YALOBUSHA COUNTY

Phillip Bros.' No. 1 James, Sec. 20-11-5 Coring 3,420 ft.
Carter Oil Co. and J. D. Collett's No. 1 Blackmur, 330 ft. S, 990 ft. W, C Sec. 14-11-4 Rigging up.

YAZOO COUNTY

Amerada Pet. Co.'s No. 1 Doherty, SW SW Sec. 24-12-2. Location.

TENNESSEE

DECATUR COUNTY

Chester County Oil Co.'s No. 1 Montgomery Cmtd. 6-in. 1,040 ft.; drlg. hard gray lime 1,165 ft.

ALABAMA

CHOCTAW COUNTY

Robinson & Greer's No. 1 Douglas Oil Co., 320 ft. N, C Sec. 15-19-2 Coring 3,400 ft.

LAMAR COUNTY

Briggs & Knapp's No. 1 Wefel, Sec. 25-15-14 Reaming to bottom; T.D. 1,180 ft.

MARION COUNTY

Hobson and others' No. 1 John Clark, SE Sec. 29-11-14. Drk. pattern.

SUMTER COUNTY

B. W. Bates' No. 1 fee, Sec. 3-18-1 U.R. surface csg. at 300 ft.; to set 6-in.

WASHINGTON COUNTY

S. A. Hobson's No. 1 Hobson Bros., Sec. 9-8-2 S.D.; S.W. flow at 1,450 ft.
S. A. Hobson's No. 1 Wilson, Sec. 27-7-1 S.D. 700 ft.

WILDCAT OPERATIONS IN SOUTHWEST TEXAS

(Continued from Page 74)

CALDWELL COUNTY

Joe Bruner's No. 1 Neil, S. Morris Sur., 400 ft. NE and NW lines Location in Magnolia tank farm at Luling; delayed by suit to compel Magnolia to move tank.
Stone et al's No. 1 Robert Guinn, Joseph Burleson Sur., 150 ft. to NE and NW lines of 225-acre farm Drlg. 2,025 ft.
Keen & Malcolm's No. 1 Mollie McNeal, George C. Kimball Sur., 3,500 ft. to W line, 860 ft. to N line, 1 mi. S from old Luling Field Spudded in.
San Antonio Pet. Corp.'s No. 1 Gusave Walkerhagen, Thomas Maxwell Sur., 150 ft. to NW and SW lines, 11 miles W from Lockhart T. D. 896 ft.; drlg.; thought to be nearing chalk.
Cranfill & Reynolds' No. 1 Berensdorf, A. Floyd Sur. Location.
W. H. Harper's No. 3 Thomas, J. Roberts Sur. Fishing for pipe.
G. R. McIntire's No. 1 J. B. Towns in Isaac Weldon Sur., 4,900 ft. to NE line, 1,350 ft. to SE line of survey Drlg.; T. D. 2,630 ft.; sand in Austin (corrected depth).

DE WITT COUNTY

Gibson & McIntyre's No. 1 Wm. Van Roeder S. D.; in gumbo at 1,440 ft.
F. P. Zoch's No. 1 Steinman, John Garelli Sur., 976 ft. from SW line, 1,797 ft. from NW line Location.
H. T. Roe's No. 1 Leinhardt Drlg. 1,630 ft. in gumbo.

DIMMITT COUNTY

Texas Fuel Gas Co.'s No. 1 City Nat'l Bank (Laxon) Setting csg. at 680 ft.
Texas Fuel Gas Co.'s No. 1 Laxon, Sur. 653, 5 miles SW Carrizo Springs T. D. 1,425 ft.; setting csg; test has shown some gas and rainbows of oil.

DUVAL COUNTY

Trussell & Partee's No. 1 E. R. Hagest, Sur. No. 271, Blk. 7, 450 ft. E line, 150 ft. S line Drlg.; T. D. 2,560 ft.; standing; sand at 2,252-56 ft.; oil, gas & S. W.
National Oil Co.'s No. 2 Ball, Agua Poquita Sur., Blk. 3. Drlg. 1,500 ft.
F. P. Zoch's No. 1 King, Blk. 25, Howwman Smith subd. W. R. King ranch, Dugo Hinojosa grant, 660 ft. N line, 660 ft. E line Location.
Southern Oil Co.'s No. 1 Welder Wood, Sur. 215 T. D. 750 ft.; standing, waiting on water.

EDWARDS COUNTY

A. M. Griffith's No. 1 Wardlaw Shut down 3,000 ft. awaiting orders; expect to drill deeper.

FAYETTE COUNTY

Muldoon Oil & Gas Co.'s No. 1 Kemp, M. Smith League. Drlg. 2,110 ft. in sand and shale.
W. J. Kelly's No. 1 Burke Shut down 1,000 ft.

FRIO COUNTY

Frank B. LeFeure's No. 1 H. W. and R. L. Eschenburg, Edward Gallgher Sur. No. 739, 3,980 ft. W of SE cor. of Edward Gallgher Sur. No. 738 and 1,320 ft. S of N line of Edward Gallgher Sur. No. 739 To start rigging up soon.

GOLIAD COUNTY

Compton Oil Co.'s No. 1 Fromme, Dexter Survey Standing.
F. P. Zoch's No. 1 Kaufman Drlg. in shale 3,985 ft.
Mission Drlg. Co.'s No. 3 Ray, 3 miles E of No. 2. T. D. 4,100 ft.; bailed salt water at 4,100 ft.
Western Union Oil Co.'s No. 1 Lucas, Juan Moya Delgado Sur. T. D. 725 ft.; installing heavy rig; test taken over by Mission Drilling Co.

GONZALES COUNTY

Acme Oil & Royalty Corp.'s No. 1 Weber, Thomas Wright Survey T. D. 1,500 ft.; took core in broken formation.
Joyce & Stephens' No. 1 Taylor, in city limits of Waelder T. D. 600 ft.; drlg. in; operators hope to make a small well.
Dunning & Pierce's No. 1 Stahl, Sarah Hendricks Sur., 150 ft. to SE and NE lines of farms Location.
Cranfill & Reynolds' No. 1 F. J. Lang, James Rodney Sur., 150 ft. from N line, 450 ft. from E line T. D. 3,470 ft.; will abandon at 3,500 ft.
Adams & Lyles' No. 1 Jackson Sur. Shut down 800 ft.
Joe Bruner's No. 1 R. D. and J. C. Miller T. D. 3,490 ft.; drilling in hard formation.
Linderman Bros.' No. 2 F. H. Frampton in Richard Heath Sur. Skidded rig 40 ft. from No. 1.
Finnell & Elam's No. 1 Robinson, Liverpool Sur. Shut down 1,730 ft.
Hoffman et al's No. 1 Borrer, J. Stewart Sur Drlg. 1,025 ft.
Marshall & Moore's No. 1 St. Clair, R. H. Wymn Sur. T. D. 1,700 ft.; shut down.
United North & South's No. 1 J. A. Kerr, in James Bowman Sur., 150 ft. S of CNL of tract, 11 miles W from Waelder T. D. 200 ft.; drlg.
United North & South Dev. Co.'s No. 1 J. E. Preston 120 acres, John Oetkins Sur., 1,350 ft. to S line, 750 ft. of W line T. D. 2,200 ft.; drlg.
L. L. Jones' No. 1 J. F. Kindred, W. W. Barnes Sur., 700 ft. W line, 1,000 ft. S line Location.
J. H. Burt et al's No. 1 E. Menking, Blk. 24, 150 ft. to N and 450 ft. to E line of Blk. 24, 14,050 ft. to NW and NE line of Sur. Rigging up.
A. G. Keiffer's No. 1 B. B. Dix T. D. 2,785 ft.; shut down.

GUADALUPE COUNTY

H. H. Weinert's No. 1 A. E. Dowdy, J. C. Darst Sur., 110 ft. S line, 36 ft. E line Location.
Shell Petroleum Corp.'s No. 1 Denmann, Jose de la Baume Sur. Moving in material; to spud in by Dec. 6.
H. H. Weinert's No. 2 A. E. Dowdy, J. C. Darst Sur., 100 ft. N line, 36 ft. E line Location.
O. W. Killam's No. 1 C. N. Adams, Jesias Randolph Sur., 150 ft to NW & NE lines of farm F. D. 2,460 ft.; drlg in shale.
J. O. Dore's No. 1 Appling, H. Cottlebur T. D. 1,000 ft.; standing; had light show of oil and gas at 650 ft.
Grayburg Oil Co.'s No. 1 Wells, Jose La Baume T. D. 3,842 ft.; drlg. in lime.
Pagenkopf & Kennon's No. 1 Halm, Joseph Kent Sur., 5 miles E of Seguin T. D. 1,683 ft.; corrected depth.
T. H. Poole et al's No. 1 F. Behring, Green LeWitt Sur. Abandoned; dry 2,356 ft.
Adams-Lyles-Walton's No. 1 Zoberoski, Jesus Cantu Sur. Drlg. 1,100 ft.

HAYS COUNTY

E. A. Bucklin's No. 1 A. Elsner T. D. 725 ft.; taken over by Chas. Bell and associates; about to resume drilling.
John H. Foster, trustee's No. 1 W. G. Barber, 7 miles SE from Buda T. D. 671 ft.; topped Edwards with show of oil; have not tested; will make another location quarter mile NW; this test first reported as J. A. Lang's No. 1 Barber.

JACKSON COUNTY

Wright Bros.' No. 7 Drushell Standing 2,875 ft.

JIM HOGG COUNTY

T. J. Conway's No. 2 Palacious, Sur. 232, Blk. 10 Drlg. 400 ft.
T. J. Conway's No. 4 Leyendecker, Blk. 9, Sur. 234, 150 ft. S line, 150 ft. E line T. D. 2,365 ft.; dry and abandoned; rock at 2,315-17 ft.; sand at 2,317-20 ft.; tested dry.
Deep Rock Oil Co.'s No. 1 Kelsey Standing 2,582 ft.
L. M. Holden's No. 4 Jones, 1,320 ft. to north line, 1,320 ft. to east line of 160 acres out of Share 5 "A" Dego Hinojosa Grant Standing 42 ft.

JIM WELLS COUNTY

E. W. Ogden's No. 1 G. Farris, M. Peres Sur. T. D. 2,404 ft.; washing to bottom to drill deeper.

KARNES COUNTY

Ruby & Claypool's No. 1 Tom, V. Zepeda Sur., 850 ft. N line, 1,600 ft. E line Shut down 1,150 ft.
Benedum-Trees' No. 1 S. E. Crews, Britton Odem Sur. Drlg. 2,700 ft.
Hurador Oil Co.'s No. 1 W. E. Porter T. D. 2,758 ft.; drlg. in hard sand.

KERR COUNTY

L. R. Page and associates' No. 1 Real T. D. 4,500 ft.; drlg. below 4,500 ft.
D. B. Mascho's No. 1 J. L. Love, C.C.S.D.&R.G.N.G. Sur., Sec. 1,594, 5,280 ft. to N line, 1,000 ft. to W line Water well completed; heavy duty cable tool rig on ground (first reported as O. E. Tunstill No. 1 Love Ranch).

KENDALL COUNTY

Borgett et al's No. 1 Haag, W. Avery Sur. Completed straight reaming; now replacing spudder with cable tool rig and building derrick; bottom of hole in shale and gumbo 600 ft.
Sterling's No. 1 Willie Werner, 2 miles NW from Borgett No. 1 Haag Drlg. 500 ft.

KLEBERG COUNTY

Bowen-Sarles' No. 1 Robert H. Simmons, Sec. 7, King subd. 3 miles W from Ricadro Derrick up; moving in rig.

KINNEY COUNTY

Lloyd Oil Co.'s No. 1 G. B. Moore, Survey 117 T. D. 2,710 ft.; in lime flowing sulphur water.

LIVE OAK COUNTY

O'Neil & Catlett No. 1 Smith, 900 ft. SW line, 150 ft. NW line Drlg. in broken shale at 2,665 ft.
Dr. J. K. Rowan Co.'s No. 1 Lynne Ranch, 171 ft. W of George West Location.
Simmons Oil Co. No. 1 Richard Coquat in Jas. C. Hill survey 2,250 ft. to S. line 1,750 ft. to E. line, 7 miles NE of Oakville Drlg. in blue gray shale 1,150 ft.

MAVERICK COUNTY

Rycade Oil Corp.'s No. 4 J. M. Chittim T. D. 5,560 ft.; setting csg.
Rycade Oil Corp.'s No. 5 Chittim Drlg. 1,500 ft.; set 10-in. csg.
Rycade Oil Co.'s No. 3 Chittim, Blk. 7, Sur. 116, I.&G.N. 175 ft. N of No. 1, 10 ft. W, 255 ft. S line T. D. 5,940 ft.; flowing 50 bbls. oil, 100 bbls. salt water and considerable gas.
The Texas Company, 5 miles west Darling Switch T. D. 3,850 ft. in brown lime; to set csg.

MEDINA COUNTY

Pan American Petroleum Co.'s No. 1 Harrison, Sur. 799 Rigging up.
Pat Armstrong's No. 1 C. W. Butts in George C. Hanson Sur. T. D. 850 ft.; in marl; W. O. fuel.
Donaldson Oil & Dev. Co.'s No. 2 Adams Co., James Hillemmeyer No. 25 Sur., 500 ft. to E line of Sur., 150 ft. to S line of N half of Sur. Derrick timbers on ground.

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TULSA, OKLAHOMA

T. N. T. Drilling Co.'s No. 1 V. Mangold, I. S. Palmer Sur. No. 20, SE cor. 1 mile from Noonan ..... Drlg. 180 ft.
Cecil Switzer's No. 1 Zen, 6 miles west of Hondo..... Fishing 3,487 ft.
R. C. Hill's No. 1 A. Wuesbach, G. Arcola Sur., 600 ft. E line, 600 ft. S line ..... Location.
Carl Brothers' No. 1 Saathoff, A. Smelzer No. 19 Sur.. T. D. 910 ft.; taken over by Carl Bros. from A. W. Skogland; shut down.

MILAM COUNTY

Service Oil & Gas Co.'s No. 1 Muldrow, L. Taylor Sur., SE cor. ..... Location.
E. L. Chapman's No. 2 Johnson, J. J. Acosta Sur. ..... Abandoned.
E. L. Chapman's No. 1 Holman in J. J. Liendo Survey.... Drlg. 2,015 ft.
Michalk & Clark's No. 1 J. M. Gilchrist, J. J. Acosta Sur., 500 ft. to S line, 150 ft. to W line of farm .... T. D. 1,150 ft.; drlg. in Taylor marl.
Noack-McCarmack's No. 1 D. D. Fowler ..... T. D. 1,838 ft.; fishing for tools.
Diggs and others' No. 1 Nolen ..... Derrick.
Hill & Bonwell's No. 1 B. Booker, James Welch Sur. .... Fishing 3,020 ft.
Lloyd Oil Corp.'s No. 1 San Clement, Fokes Sur. ..... Spudded in.
A. H. Wray's No. 1 D. D. Fowler ..... Drlg. 964 ft. in sandy shale; had odor of gas at 955 ft.

McMULLEN COUNTY

Sun Oil Co.'s No. 1 Berry, J. Poitenent Sur. No. 9 ..... T. D. 1,050 ft.; coring entire depth using Elliott core barrels; samples taken every 5 ft.
Cowboys Oil Co.'s No. 1 Shiner, H. M. Brewer Sur. ..... T. D. 2,280 ft.; tested salt water and little gas 2,255-77; now drilling.

NUECES COUNTY

Nueces River Basin Dev. Co.'s No. 1 F. C. Allen ..... T. D. 3,945 ft.; junked and abandoned in sand 3,945 ft.; fishing job with 8¾-in. csg. collapsed near top of hole.
H. Grimm et al's No. 1 A. R. Roberts, Blk. 79, Winter Vegt. Garden Subdivision, 6 miles NW of Robstown, 12 miles NE Agua Dulce Field ..... T. D. 1,891 ft.; shut down in shale.
Trinity Drillers and Sun Co.'s No. 1 Tompkins ..... T. D. 4,200 ft.; dry and abandoned.

SAN PATRICIO COUNTY

LaFeria Oil & Gas Co.'s No. 1 C. C. Smith in J. C. White Survey, 690 ft. to north line, 350 ft. to east line .... Drlg. in shale at 1,920 ft.

STARR COUNTY

The Texas Company's No. 4-A V. G. Guerra, Porcion 67, Share 305-D ..... T. D. 3,590 ft. (depth corrected); tested 16 trebles oil and mud; W. O. C.
Smith & Adams' No. 1 Welch, Pedernal Sur. ..... Drlg. 600 ft.

WEBB COUNTY

Everett Suladie's No. 1 Bruni Sur. 131, 150 ft. S line, 150 ft. W line of NW of SE ..... Rigging up.

UVALDE COUNTY

Waldrop & Welch's No. 1 H. S. Benson, 2 miles northwest of Uvalde ..... T. D. 580 ft.; setting 8¼-inch csg.; hole making small amt. gas.
Phantom Oil Co.'s No. 1 Claudt Sur. 661 ..... Moving in machinery.

WILSON COUNTY

R. M. Sherer's No. 1 Tummilson, A. Trevena Sur. ..... 457 ft.; standing.
Tidal Oil Co.'s No. 1 Felix Kulesza, Susanna Larrison Sur., 235 ft. to E line, 1,320 ft. to S line of 647-acre tract ..... Drlg. 1,530 ft.
Trinity Drillers' No. 1 Richter in Trevino Sur., 3,005 ft. to E line, 250 ft. to N line of 58-ac. lease ..... Rigging up.
Rycade Oil Corp. et al's No. 1 George Hice, Juan Delgado Sur., 650 ft. W of Cibolo River, 150 ft. SE line of tract ..... Location.
Grayburg Oil Co.'s No. 1 Tigler, Parrot Sur. ..... T. D. 3,396 ft.; temp. shut down.
R. M. Sherer's No. 1 First State Bank of Stockdale, Moran Sur. ..... 220 ft.; standing.

ZAPATA COUNTY

R. F. Blankenship's No. 1 G. T. Montemeyer, Sur. 45, Blk. 7, 150 ft. N & E lines ..... T. D. 1,320-21 ft.; sand; set 4½-in. csg. 1,320 ft.
Magnolia Pet. Co.'s No. 2 F. G. Martinez Sur. No. 6, 660 ft. to N line, 660 ft. to E line ..... Drlg. 2,089 ft.; sand at 2,079-80 ft. tested small show oil.
O. W. Killam's No. 1 J. G. Martinez Sur No. 2, 550 ft. W line, 150 ft. S line of SE of Sur. ..... Rigging up.
Magnolia Pet. Co.'s No. 3 F. G. Martinez Sur. No. 6, 660 ft. N line, 660 ft. E line of W half of Sur. ..... T. D. 1,872 ft.; sand at 1,872 ft. tested gas through tester. W. O. C.
John Pappas' No. 2 Cuellar, Por. 33 and 34 ..... Drlg. 1,600 ft.
Shell Pet. Co.'s No. 2 Lopez, Blk. 11, Sur. 288, 600 ft. NW line, 600 ft. SW line ..... T. D. 1,114 ft.; standing; waiting on orders.
National Oil Co.'s No. 1 D. B. Adams ..... Standing 670 ft.; showing some gas; waiting on water.
Marts & Beavens' No. 1 Trevino, Blk. 2, Porcions 2 and 3, Sur. 1, 150 ft. SE line and SW line ..... Drlg. 2,365 ft.

ZAVALA COUNTY

Tritex Oil Co.'s No. 1 Clay Burns ..... T. D. 780 ft.; standing.
Chicago Merchants Produce Co.'s No. 1 fee, 1 mile E of La Pryor ..... Drlg. 1,000 ft.
Tritex Oil Co.'s No. 2 Childress, one-fourth mile NW of old Dominion Co.'s No. 1 Pryor ..... Drlg. 650 ft.

GULF COAST FIELDS AND WILDCATS

(Continued from Page 73)

Humble & Valley's No. 7 Mueller ..... Drlg. sand 3,090 ft.
Humble & Valley's No. 8 Mueller ..... Derrick
Humble & Valley's No. 4-A Bracey ..... Drlg. shale 3,546 ft.
Humble & Valley's No. 5-A Bracey ..... Drlg. shale and sand 3,370 ft.
Humble & Valley's No. 6-A Bracey ..... Derrick.
Humble & Valley's No. 3 Ollie Wilson ..... Drlg. shale and sand 3,459 ft.
Humble & Valley's No. 6 Gotosky ..... Rig
Humble & Valley's No. 3 Sherrill ..... Cmtd. csg. to test oil sand 3,194 ft.
Humble & Valley's No. 1 Duncan, State land ..... Rig
Humble & Valley's No. 5 Thompson ..... Drlg. sandy shale 3,523 ft.
Humble & Valley's No. 6 Thompson ..... Derrick.
Humble & Valley's No. 4 Payne ..... Drlg. sticky shale 933 ft.
Humble & Valley's No. 5 Payne ..... Derrick
Humble & Valley's No. 6 Payne ..... Derrick
Humble & Valley's No. 3-A Washington ..... Derrick

DE WALT—FORT BEND COUNTY

Humble Oil & Refining Co.'s No. 2-C Bankers Mortgage.. Rig.
Humble Oil & Refining Co.'s No. 11 Brazos ..... Derrick
Humble Oil & Refining Co.'s No. 12 Brazos ..... Cmtd. surface csg. 1,249 ft.
Humble Oil & Refg. Co.'s No. 9 Camp ..... Drlg. shale 2,174 ft.
Humble Oil & Refg. Co.'s No. 8 Hamner ..... Drlg. plug to test sandy shale 3,630 ft.
Humble Oil & Refg. Co.'s No. 10 Sugarland (workover)... Rigging up to deepen.
Humble Oil & Refg. Co.'s No. 11 Sugarland ..... Drlg. sticky shale 2,913 ft.
Humble Oil & Refg. Co.'s No. 12 Sugarland ..... Rigging up to pump 3,785 ft.
Humble Oil & Refg. Co.'s No. 13 Sugarland ..... Rig.
Humble Oil & Refining Co.'s No. 2-B Sugarland ..... Drlg. sand 848 ft.
Humble Oil & Refg. Co.'s No. 7 Nelson ..... Cmtd. 6⅝-in. csg.; T. D. 3,705 ft.

HUMBLE—HARRIS COUNTY

Continental Oil Co.'s No. 1 Cezeaux, south side ..... Shut down, total depth 4,520 ft.
Gardner Oil Co.'s No. 1 Perkins ..... Sandy shale 2,019 ft. Wait casing
Humble Oil & Refg. Co.'s No. 6 Williams ..... Drlg. shale and lime 3,677 ft.
Humble Oil & Refg. Co.'s No. 7 Williams (south) ..... Drlg. sandy shale 5,330 ft.
Humble Oil & Refg. Co.'s No. 8 Williams (south) ..... Rig
Humble Oil & Refg. Co.'s No. 9 Williams, south ..... Rig
Humble Oil & Refg. Co.'s No. 10 Williams (south)..... Rig
Humble Oil & Refg. Co.'s No. 1 Glass, south ..... Abandoned 7,019 ft.

Humble Oil & Refg. Co.'s No. 1 Oates ..... Abandoned 5,404 ft.
Harvey Smith et al's No. 2 Ward ..... Comp. flowing estimated 750 bbls. oil daily 4,356 ft.

Humble Oil & Refining Co.'s No. 2 Trahon (south) ..... Derrick.
Morris Investment Co.'s No. 1 fee ..... Preparing to test oil sand 1,407 ft.
South Texas Petroleum Co.'s No. 12 Morris (south) ..... Drlg. sticky shale 5,072 ft.
South Texas Petroleum Co.'s No. 13 Morris (south) ..... Drlg. gumbo 1,597 ft.
Sun Oil Co.'s No. 3 Bender (northwest) ..... Drlg. gumbo and lime 3,120 ft.
South Texas Petroleum Co.'s No. 2 Lee (south) ..... Drlg. gumbo 2,425 ft.
The Texas Company's No. 2 Dunman, south side ..... Drlg. gumbo 961 ft.
The Texas Company's No. 3 Dunman, south side ..... Derrick.
The Texas Company's No. 41 Stevenson (south) ..... Drlg. sandy shale showing oil 4,976 ft.
The Texas Company's No. 23 House ..... Set 6⅝-in. csg. 4,000 ft. in sidetracked hole.
West Production Co.'s No. 2 Foster ..... Rig.

BLUE RIDGE—FORT BEND COUNTY

Cunningham Prod. Co.'s No. 6 Blakely (workover) ..... Drlg. 2,899 ft.
Sinclair Oil & Gas Co.'s No. 5 Davidson (workover) ..... Drlg. 4,438 ft.
So. Texas Petroleum Co.'s No. 5 Blakely ..... Comp. flowing 613 bbls. fluid, 35 per cent b.s. and water, daily 3,524 ft.

PIERCE JUNCTION—HARRIS COUNTY

Anderson & Plummer's No. 6 Whitehead (workover) .... Cmtd. 9⅝-in. csg. 4,729 ft.; to test oil sand 4,749 ft.

Gulf Production Co.'s No. 31 Taylor ..... Rig
Navarro Oil Co.-Texas Exploration Co.'s No. 17 Dooley ... Drlg. gumbo 4,768 ft.
Rio Bravo Oil Co.'s No. 11-B Settegast ..... Drlg. sand and shale 4,618 ft.
Rio Bravo Oil Co.'s No. 16-A Settegast, west ..... Tested salt water 4,215 ft.; pulling liner to deepen.

Rio Bravo Oil Co.'s No. 17-A Settegast, west ..... Drlg. sand 3,954 ft.
Saxet Gas Co.'s No. 5 Herman (southwest) ..... Drlg. gumbo 3,846 ft.
Saxet Gas Co.'s No. 6 Herman, southwest ..... Drlg. lime rock 2,243 ft.
Saxet Gas Co.'s No. 7 Herman, southwest ..... Derrick.
Superior Oil Co.'s No. 3 B. Whitehead (workover) ..... Rigging up to pump 4,469 ft.
Superior Oil Corp.'s No. 2 Herman, southwest ..... Drlg. gumbo 681 ft.
J. F. Barron's No. 3 Fitzsimmons ..... Derrick.
Shaw & Texas Exploration Co.'s No. 2-F Fitzsimmons .. Derrick.
Shaw et al's No. 4-E Fitzsimmons ..... Drlg. shale and sand 4,466 ft.
Smith & Plummer's No. 1 Settegast ..... Drlg. gumbo 5,196 ft.

LIBERTY—LIBERTY COUNTY

Abercrombie & Harrison's No. 4 fee (workover) ..... Set strainer 3,066 ft.
Empire Gas & Fuel Co.'s No. 9 Groggan ..... Drlg. 1,100 ft.
Empire Gas & Fuel Co.'s No. 10 Groggan ..... Spudded.
Sun Oil Co.'s No. 52 Mitchell ..... To test sandy shale showing oil 3,279 ft.

Sun Oil Co.'s No. 53 Mitchell ..... Coring 3,162 ft.
The Texas Company's No. 5 Green (workover) ..... Pulling screen to deepen 3,290 ft.

HULL—LIBERTY COUNTY

Empire Gas & Fuel Co.'s No. 30 Barngrover ..... Drlg. 2,637 ft.
W. B. Flynn's No. 8 Harrison (workover) ..... Drlg. 3,226 ft.
Gulf Production Co.'s No. 50 Phoenix (workover) ..... Drlg. 3,901 ft.
Gulf Production Co.'s No. 76 Phoenix (workover) ..... Drlg. 3,588 ft.
Houston Production Co.'s No. 14 Barngrover ..... Rig.
Humble Oil & Refg. Co.'s No. 12 Hooks-Spell ..... Comp. flowing 700 bbls. oil 3,949 ft.

Ocean Springs Oil Co.'s No. 1-H Palmer ..... Drlg. 677 ft.
Republic Production Co.'s No. 56 Dolbear (workover) ... Drlg. 1,066 ft.
Republic Production Co.'s No. 76 Dolbear (workover) ... Drlg. deeper 3,058 ft.
Republic Production Co.'s No. 132 Dolbear (workover) .. Drlg. 2,224 ft.
The Texas Company's No. 7 Hannah-Vacuum (workover) . To deepen.
The Texas Company's No. 8 Hannah-Vacuum ..... Rigging up.

BIG CREEK—FORT BEND COUNTY

Benedum & Trees' No. 1 J. F. Ahlers ..... Derrick.
Benedum & Trees' No. 1 Moore ..... Drlg. heaving shale 4,135 ft.
Gulf Production Co.'s No. 45 Davis (workover) ..... Drlg. 3,762 ft.
Gulf Production Co.'s No. 57 Davis ..... Drlg. gumbo and lime 4,157 ft.
The Texas Company's No. 3 fee (old well) ..... Pulling liner 4,378 ft.

LOST LAKE—CHAMBERS COUNTY

Pure Oil Co.'s No. 4 Mayes ..... Drlg. sticky shale 3,063 ft.
Pure Oil Co.'s No. 5 Mayes ..... Drlg. sticky shale 2,818 ft.
Pure Oil Co.'s No. 6-A Mayes ..... Set 12½-in. csg. in gumbo 1,108 ft.

Pure Oil Co.'s No. 7 Mayes ..... Cmtd. 8¼-in. csg. 2,796 ft. to test sandy shale 2,840 ft.

Pure Oil Co.'s No. 8 Mayes ..... Drlg. shale 2,823 ft.
Pure Oil Co.'s No. 3 Lost Lake ..... Cored cap rock 4,189-96 ft.

NASH—BRAZORIA COUNTY

Rycade Oil Corp.'s No. 26 Wisdom ..... Drlg. hard shale and lime 5,387 ft.

BATSON—HARDIN COUNTY

Ada Belle Oil Co.'s No. 130 Carlton ..... Drlg. 1,100 ft.
Paraffine Oil Co.'s No. 81 Paraffine ..... Drlg. 459 ft.

SOUR LAKE—HARDIN COUNTY

Austin et al's No. 1 Watson ..... Drlg. 296 ft.
Lake View Oil Co.'s No. 8 Minor ..... Drlg. 181 ft.
Gilbert Oil Co.'s No. 107 Gilbert ..... Derrick.
M. E. Deveto Oil Co.'s No. 1 Cannon ..... Comp. pumping 50 bbls. oil, 10 bbls. water, 1,304 ft.

The Texas Company's No. 287 fee ..... Drlg. 2,429 ft.

SARATOGA—HARDIN COUNTY

Paggi et al's No. 5 Queen City ..... Comp. pumping 40 bbls. fluid, 60 per cent water, 1,188 ft.

Rio Bravo Oil Co.'s No. 86 Cotton ..... Spudded.

ORANGE—ORANGE COUNTY

Supreme Oil Co.'s No. 3 Jackson (workover) ..... To deepen.
Sinclair Oil & Gas Co.'s No. 5 Gailliere (workover) ... Rigging up to deepen.

GOOSE CREEK—HARRIS COUNTY

Cedar Bayou Oil Co.'s No. 11 Busch ..... Testing oil sand 2,611 ft.
Russell Ferrell's No. 4 Gillette (workover) ..... Pulling screen to deepen
Humble Oil & Refg. Co.'s No. 19 Ashbell-Smith ..... Rigging up to pump 2,479 ft.
Humble Oil & Refg. Co.'s No. 76 Simms-Smith ..... Drlg. sand and shale 4,856 ft.
Lake Shore Oil Co.'s No. 4 Duke ..... Shut down 2,594 ft.
J. M. West, trustee, No. 3 Scorrega ..... Drlg. 4,020 ft.

SPINDLETOP—JEFFERSON COUNTY

Yount Lee Oil Co.'s No. 28 McFaddin (workover) ..... Fishing 4,799 ft.
Yount Lee Oil Co.'s No. 31 McFaddin (workover) ..... Testing sand showing oil 4,139 ft.
Yount Lee Oil Co.'s No. 97 McFaddin (workover) ..... Drlg. sandy shale 5,246 ft.
Yount Lee Oil Co.'s No. 119 McFaddin ..... Drlg. lime rock 4,448 ft.
Yount Lee Oil Co.'s No. 120 McFaddin ..... Drlg. sand and lime 3,464 ft.
Yount Lee Oil Co.'s No. 121 McFaddin ..... Rig.
Yount Lee Oil Co.'s No. 85 Gladys City (workover) .... Drlg. sand 2,993 ft.
Yount Lee Oil Co.'s No. 97 Gladys City ..... Drlg. sand and shale 4,726 ft.
Yount Lee Oil Co.'s No. 99 Gladys City ..... Rigging up.
Yount Lee Oil Co.'s No. 11 fee (workover) ..... Drlg. sand and lime 3,748 ft.

WEST COLUMBIA—BRAZORIA COUNTY

Continental Oil Co.'s No. 1 Hogg ..... Drlg. shale 5,945 ft.
Gulf Production Co.'s No. 3-B Hogg ..... Drlg. shale 3,972 ft.
Humble Oil & Refg. Co.'s No. 3 Smith ..... Reaming; bottom in heaving shale 5,173 ft.

Saxet Oil Co.'s No. 2 Hogg ..... Cmtd. 6⅝-in. csg. 3,558 ft.; to test sand 3,560 ft.

The Texas Company's No. 25 Arnold ..... Sand showing oil 2,767-74 ft.; cmtd. 6⅝-in. csg. 2,764 ft.

HIGH ISLAND—GALVESTON COUNTY

Gulf Production Co.'s No. 5-A Smith ..... Drlg. 3,632 ft.
Marrs McLean's No. 6 Cade (old well) ..... Drlg. 3,731 ft.
Marrs McLean's No. 12 Cade (workover) ..... To deepen.
Marrs McLean's No. 17 Cade ..... Location.

ORCHARD—FORT BEND COUNTY

Gulf Production Co.'s No. 19 Moore ..... Abandoned 6,756 ft.; tested dry in sidetracked hole 5,757 ft.

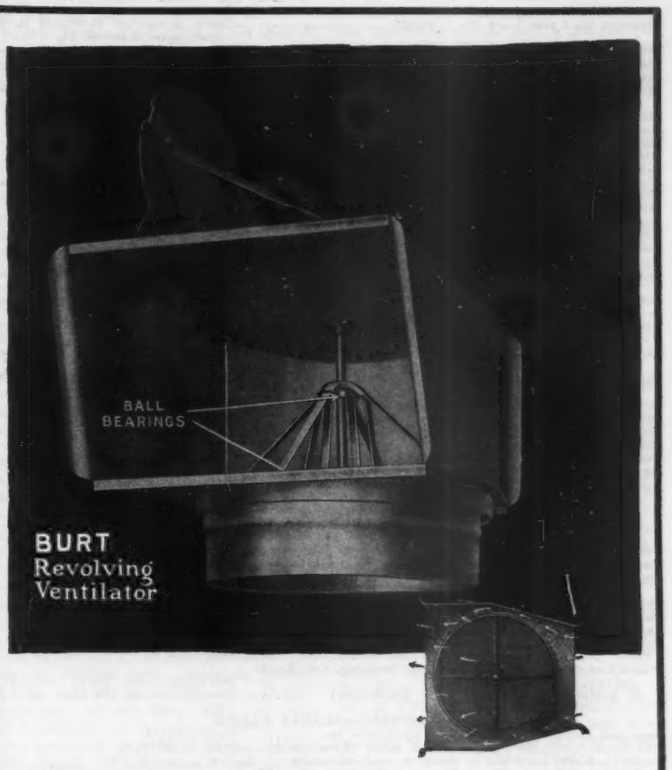
DAMON MOUND—BRAZORIA COUNTY

H. R. Cullen's No. 2 Smith ..... Drlg. shale 2,592 ft.

REFUGIO—REFUGIO COUNTY

Benedum & Trees' No. 3 Rooke ..... Rebuilding derrick to deepen 3,86 ft.

Morgan Oil Corp.'s No. 1 Fox, Block 72 ..... Drlg. shale 1,817 ft.
Morgan Oil Corp.'s No. 1 Johnson ..... Rig
Morgan Oil Corp.'s No. 1 Strauch ..... Comp. flowing 200 bbls. pipeline oil 3,683 ft.



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that grows with years of perfect service

Time does not diminish the effectiveness of Burt Revolving Ventilators. Many of them have been in constant service for over fifteen years and are today giving the same positive results that got them their job when they were first installed.

The main reason for this durability is the fact that only the highest grade bearings and heavier gauge metals are used in their construction. There is never any danger of lost efficiency through sticking or binding on the part of the ball or roller bearings.

And yet Burts cost no more than other similar ventilators which are much less positive in their results. Thirty-five years in the business has given Burt the experience necessary to produce a high grade product at a low factory cost.

Your building deserves Burts—from the standpoint of ventilating efficiency and appearance. And, of course, our engineers will gladly help you select the proper size to handle your problem in the most economical manner.

If you have a condition which is exceptionally severe, we advise the use of the Burt Direct Connected Fan Ventilator.

The BURT MFG. Co.

Ventilators-Oil Filters-Exhaust Heads

929 S. High St. Akron, Ohio

Herman F. Heep's No. 1 Rutherford ..... Derrick.
Houston Gulf Gas Co.'s No. 6 Shelly ..... Comp. estimated 30,000,000 ft. dry gas; sand 3,680-88 ft.
Houston Gulf Gas Co.'s No. 1 Lambert ..... Drlg. sticky shale 3,335 ft.
Houston Gulf Gas Co.'s No. 4 Fannie Heard (workover) .. Comp. gas well 3,611 ft.
Houston Gulf Gas Co.'s No. 3 Tom Heard ..... Drlg. sticky shale 3,559 ft.
Houston Gulf Gas Co.'s No. 2 Cummings ..... Cmtd. 8¼-in. csg. to test oil sand 3,652-59 ft.
Houston Gulf Gas Co.'s No. 2 Morgan Shelly ..... Testing oil sand 3,651-59 ft.
Houston Gulf Gas Co.'s No. 9 J. A. Lambert (workover).. Rig up to work over.
Houston Gulf Gas Co.'s No. 2 Morgan-Vance ..... Derrick.
Mission Drlg. Co.'s No. 1 Henry Heard ..... Drlg. sticky shale 2,838 ft.
Mission Drlg. Co.'s No. 2 O'Brien ..... Drlg. sand 1,860 ft.
Mission Drlg. Co.'s No. 3 Mitchell ..... Reaming to bottom 4,932 ft.
Mission Drlg. Co.'s No. 2 Powers (workover) ..... Rig.
Mission Drilling Co.'s No. 1 Ben Shelton ..... Derrick.
Ohmer Oil Co.'s No. 3 Ryalls ..... Rig.
Refugio Oil Corp.'s No. 2 Murphy ..... Drlg. 2,100 ft.
Saxet Oil Co.'s No. 1 Ryals ..... Drlg. sticky shale 2,802 ft.
Saxet Oil Co.'s No. 3 Holmes Heard ..... Derrick.
Saxet Oil Co.'s No. 11 Clint Heard ..... Flowed 30 bbls. fluid, 5 per cent water; sand 3,672-80 ft.
Houston Oil Co.'s No. 9 Wilson Heard ..... To test sand showing oil approximately 3,680 ft.
Houston Oil Co.'s No. 11 Pratt-Hewitt-Rooke ..... Drilling.
Houston Oil Co.'s No. 12 Pratt-Hewitt-Rooke ..... Location.
Independent Oil & Gas Co.'s No. 1 O'Brien ..... Drlg. shale 6,227 ft.; tested salt water 5,982 ft.
Independent Oil & Gas Co.'s No. 1 Claude Heard ..... Cem. 9⅝-in. casing 3,668 ft.; total depth 3,674 ft.
Independent Oil & Gas Co.'s No. 1-A J. F. B. Heard ..... Drlg. 980 ft.
Independent Oil & Gas Co.'s No. 4 Reilly ..... Drlg. 966 ft.
Independent Oil & Gas Co.'s No. 5 Reilly ..... Drlg. 2,604 ft.
Larco Co.'s No. 1 Strauch ..... Drilling.
Pearson Properties' No. 1 Bailey ..... Derrick.
Ed Price et al's No. 1 Mission River ..... Derrick.
The Texas Company's No. 1 Clint Heard ..... Deepened from 3,672 ft. to 3,682 ft.; comp. as gas well 1,500 pounds.

SOUTH LOUISIANA FIELDS

LOCKPORT—CALCASIEU PARISH

Vacuum Oil Co. & Gulf Refining Co.'s No. 25 Miller ..... Derrick.
Vacuum Oil Co. & Gulf Refining Co.'s No. 8 Bordages ... Rig.
Vacuum & Gulf's No. 3 State ..... Drlg. oil sand 5,610 ft.

HACKBERRY—CAMERON PARISH

Calcasieu Oil Co.'s No. 5 Lemke ..... Drlg. lime 3,943 ft.
Calcasieu Oil Co.'s No. 4 Caldwell ..... To test sand and shale 5,124 ft.
Calcasieu Oil Co.'s No. 8 Valery ..... Abandoned.
Rycade Oil Corp.-Humble Oil & Refg. Co.'s No. 4 Gulf Land ..... Drlg. 526 ft.
Yount Lee Oil Co.'s No. 2 Carter & Sweeney, Old Hackberry ..... Reaming; total depth 4,326 ft.
J. F. Sutton' No. 1 Duhon (Old Hackberry) ..... Comp. flowing 500 bbls. oil 3,198 ft.

JENNINGS—ACADIA PARISH

Jennings Petroleum Co.'s No. 3 Syndicate fee ..... Drlg. 1,631 ft.
The Texas Company's No. 5 Rayne heirs (King tract).... Drlg. 5,247 ft.
Yount Lee Oil Co.'s No. 5 Crowley, Sec. 48-9s-3w ..... Rig.
Yount Lee Oil Co.'s No. 7 Houssiere-Latrielle, Sec. 47-9s-3w ..... Drlg. approximately 7,400 ft.
Yount Lee Oil Co.'s No. 1 E. F. Simms (northwest side).. Drlg. 5,479 ft.

EDGERLY—CALCASIEU PARISH

C. H. Fox, trustee, No. 1 Reed ..... Derrick.
C. H. Fox, trustee, No. 1 Koonce ..... Location.
Green Oil Co.'s No. 2 Moore (workover) ..... Shut down 2,844 ft.
Hercules Oil Co.'s No. 3 Paraffin (workover) ..... Drlg. 3,594 ft.
Rex Petroleum Co.'s No. 10 Hunter (workover) ..... Rigging up to deepen.
Rex Petroleum Co.'s No. 1 Narroni (workover) ..... Junked and abandoned 3,928 ft.

VINTON—CALCASIEU PARISH

Marrs McLean's No. 4 Gray (workover) ..... Drlg. 1,699 ft.
Vinton Petroleum Co.'s No. 19 Vincent (workover) ..... Rigging up to pump 2,352 ft.
Vinton Petroleum Co.'s No. 7 Gray (workover) ..... Rigging up to pump 2,887 ft.

BAYOU BOUILLON—ST. MARTIN PARISH

Rycade Oil Corp.'s No. 7 Bouillion fee ..... Shot and pulled stuck drill pipe 4,806 ft.
Rycade Oil Corp.'s No. 9 Bouillon fee ..... Location.
Rycade Oil Corp.'s No. 2 Atchafalaya fee (oil well) .... Rig up to deepen; present depth 3,045 ft.

STARKS—CALCASIEU PARISH

J. O. Davis' No. 1 Industrial ..... Rig.
Gulf Refining Co.'s No. 17 Lutcher-Moore ..... Rig.

SWEET LAKE—CAMERON PARISH

Pure Oil Co.'s No. 7 Yount Lee ..... Standing cem. 6,881 ft.
Pure Oil Co.'s No. 9 Yount Lee ..... Moving in rig.

SORRENTO—ASCENSION PARISH

Gulf Refining Co.'s No. 16 United Land Co... ..... Drlg. 3,269 ft.; no showing.

MISCELLANEOUS WILDCATS

TEXAS

AUSTIN COUNTY

Empire Gas & Fuel Co.'s No. 1 Jackson, San Felipe..... Tested black sulphur water 3,143 ft.

BRAZORIA COUNTY

Mills Bennett Production Co.'s No. 1 Allen, Allen Dome.. Drlg. hard lime 3,018 ft.
Faust et al's No. 5 Faust ..... Drlg. gumbo 2,912 ft.
Shell Petroleum Corp.'s No. 1 Blakely-Winston, Danbury ..... Drlg. blue sticky shale 1,620 ft.
Steel & Strickland's No. 1 Lockridge ..... Rig.

CHAMBERS COUNTY

Chicago Oil Corp.'s No. 1 Lawrence ..... Drlg. 3,052 ft.

FORT BEND COUNTY

Pure Oil Co.'s No. 1 Farris, Roberts Sur. ..... Location.

HARRIS COUNTY

Baldwin and associates' No. 1 Kitzman, Cypress ..... Shut down 4,055 ft.
R. E. Brooks' No. 1 Beall, Eureka ..... Spudded.
Golf Crest Oil Co.'s No. 1 Gulf Crest ..... Standing 2,520 ft.
A. F. Belunek's No. 1 Thompson ..... Rig.
Cranfill & Reynolds' No. 1 Brown ..... Drlg. shale 3,120 ft.
Hammond et al's No. 1 Brodt ..... Gumbo 1,190 ft.; shut down after fire.
Higgins Oil & Fuel Co.'s No. 1 Sladous, Mykawa ..... Rig.
Humble Oil & Refg. Co.'s No. 6 Warren Hockley..... Abandoned 4,797 ft.
Humble Oil & Refg. Co.'s No. 7 Warren, Hockley ..... Derrick.
Humble Oil & Refg. Co.'s No. 2 Minnetex ..... Drlg. hard sand 1,177 ft.
Humble Oil & Refg. Co.'s No. 1 Sladous (workover) .... Rigging up to deepen.
Humble Oil & Refg. Co.'s No. 2 Woodburn ..... Cmtd. 13⅜-in. csg. 3,405 ft.; to test sand showing dry gas 3,425 ft.
Rich et al's No. 1 Highlands ..... Derrick.
Torsen et al's No. 1 Stewart ..... Shut down 2,580 ft.
Watts Brothers' No. 1 Hubert, Mykawa ..... Drlg. gumbo 2,650 ft.
York & Robertson's No. 1 Garrett, Harris & Carpenter Sur. ..... Sandy shale 1,917 ft.; shut down.

JEFFERSON COUNTY

Deep Test Oil Corp.'s No. 1 Faith-McFadden ..... No report.
Gulf Production Co.'s No. 8 Bordages ..... Drlg. gumbo 3,520 ft.
Gulf Production Co.'s No. 4 Burrell ..... Drlg. 3,426 ft.
Gulf Production Co.'s No. 2 Guy Junker, Fannette ..... Started drilling.
River Oil Corp.'s No. 1 Ship Channel, Brown Survey .... Standing.
Rosedale Oil Co.'s No. 1 Walker ..... Shut down.
The Texas Company's No. 2 Pipkin, Big Hill ..... Drlg. sticky shale 5,779 ft.
The Texas Company's No. 1 Fitzhugh, Big Hill ..... Cmtd. 6⅝-in. casing 5,050 ft.

LIBERTY COUNTY

Campbell et al's No. 1 fee ..... Rig.
Gulf Production Co.'s No. 1 Weiser ..... Drlg. 5,149 ft.
Gulf Production Co.'s No. 3 Boyt, Hankamer ..... Drlg. 3,111 ft.
Humble Oil & Refg. Co.'s No. 6 Sterling, Moss Bluff .... Cmtd. 6⅝-in. csg. to test sand 5,656 ft.
Cranfill Reynolds Co.'s No. 1 Vajdak, Sheeks ..... Drlg. salt water sand 5,464 ft.
Cranfill Reynolds' No. 1 Thomas Davis, Sheeks ..... Drlg. gumbo 2,203 ft.
Yount Lee Oil Co.'s No. 2 Moores Bluff, Sheeks ..... Spudded.

MATAGORDA COUNTY

Cockburn et al's No. 1 Hawkins, Shepherds, Mott ..... Location.

MONTGOMERY COUNTY

Kelley-Baker et al's No. 1 Juerges ..... No report.

ORANGE COUNTY

Gulf Production Co.'s No. 1 J. E. Starks, Port Neches ... Drlg. sand 5,102 ft.
Gulf Production Co.'s No. 1 M. H. Starks, Port Neches ... Location.
The Texas Company's No. 1 Polk, Port Neches ..... Waiting storage to test 3,146 ft.

WALLER COUNTY

Talbert & Markle's No. 1 Young ..... No report.

SOUTH LOUISIANA

ASCENSION PARISH

Triumph Oil Corp.'s No. 2 Lacey, Sec. 20-10s-4e ..... No report.

ASSUMPTION PARISH

Gulf Refining Co.'s No. 1 Armitese, Napoleonville ..... Rig.
Poor Boys Drilling Co.'s No. 1 LeBarre, Sec. 47-12s-13e .. Rigging up.

CALCASIEU PARISH

Wilfred Sahay's No. 2 James ..... Drlg. 3,800 ft.

CAMERON PARISH

Shell Pet. Corp.'s No. 6 Watkins, Black Bayou ..... Cmtd. csg. 5,956 ft.
Shell Pet. Corp.'s No. 1 Marceaux, Mallard Bay, Sec. 32-12s-3w ..... Cored hard sandy lime 5,249 ft.
The Texas Company's No. 5 Calcasieu Lake, Calcasieu Lake Dome ..... Location.
Yount Lee Oil Co.'s No. 1 Starks, Sec. 1-15s-15w ..... Drlg. gumbo and lime 6,356 ft.

IBERIA PARISH

Gulf Refining Co.'s No. 11 State, Loreauville ..... Abandoned in salt 1,401 ft.
The Texas Company's No. 4 Vermillion Bay ..... Drlg. gumbo 3,863 ft.

IBERVILLE PARISH

Shell Petroleum Corp.'s No. 4 Wilbert, White Castle .... Location.
Standard Oil Co.'s No. 3 Wilbert, Bayou Blue ..... Derrick.
Standard Oil Co.'s No. 4 Wilbert, Bayou Blue ..... Drlg. 941 ft.
Standard Oil Co.'s No. 5 Wilbert, Bayou Blue ..... Building derrick.
Standard Oil Co.'s No. 5 Schwing, Bayou Blue ..... Drlg. 1,000 ft.

JEFFERSON DAVIS PARISH

Vacuum Oil Co.'s No. 2 DeVilbiss, Roanoke ..... Drlg. gumbo and lime 6,631 ft.
Yount Lee Oil Co.'s No. 1 Courtney, Welsh ..... Spudding.

LA FOURCHE PARISH

Gulf Refining Co.'s No. 25 Stark, Thibodaux ..... Drlg. 746 ft.
Gulf Refg. Co.'s No. 1 City of New Orleans, Bay Champagne ..... Rig.

PLAQUEMINE PARISH

Humble Oil & Refg. Co.'s No. 1 Cockrell-Moran, Lake Grand Ecaille ..... Drlg. 600 ft.
Humble Oil & Refining Co.'s No. 1 Lake Washington, Lake Grand Ecaille ..... Reaming 4,260 ft.
The Texas Company's No. 3 Garden Island Bay ..... Drlg. 800 ft.

ST. LANDRY PARISH

Elbof Exploration Co.'s No. 1 Ledoux, Eunice..... Drlg. 3,020 ft.
Herbert-Baker Oil Co.'s No. 1 Fisher, Section 10-3S-4e.. Drlg. 2,112 ft.

ST. MARY PARISH

Louisiana Land & Expl. Co.'s No. 1 Clark, Lot 15-16s-12e.. No report.

ST. MARTIN PARISH

Bayou Teche Oil Co.'s No. 1 Fournet, Cypress Island..... No report.
Ohio Oil Co.'s No. 5 Martin, Hager ..... Derrick.
The Texas Company's No. 1 fee, Hager Dome ..... Drlg. 5,406 ft.
The Texas Company's No. 3 fee, Hager ..... Location.
The Texas Company's No. 2 St. Martin, Hager ..... Drlg. 4,267 ft.
The Texas Company's No. 4 fee, Hager ..... Location
The Texas Company's No. 1 Iberville, Hager ..... Drlg. 1,487 ft.
The Texas Company's No. 2 Iberville, Hager ..... Location.
The Texas Company's No. 3 Iberville, Hager ..... Location.

TANGIPAHOA PARISH

Completion Oil Co.'s No. 1 Amos ..... No report.
Joan Development Co.'s No. 1 Hilton, Sec. 20-9s-9e ..... Cem. 6⅝-in. casing 3,000 ft.; standing.

TERREBONNE PARISH

The Texas Company's No. 4 State-Bay St. Elaine ..... Location.
The Texas Company's No. 2 La. L. & E. Co., Dog Lake.. Shut down 800 ft.; waiting water.
The Texas Company's No. 1 State—Bay Junop..... Total depth 4,778 ft.; oil sand; sidetracking 3,530 ft.
The Texas Company's No. 3 State—Lake Pelto..... Derrick.
The Texas Company's No. 2 State—Caillou Island..... Rig.
The Texas Company's No. 3 State—Lake Barre ..... Rig.

SOUTHWEST TEXAS

(Continued from Page 74)

No. 1 Garza, Block 12, Survey 40, 450 feet NW line, 150 feet NE line, location.

Schoolfield-O'Byrne—Duval County

C. E. Long's (Shell) No. 4 Hahl, Block 26, Survey 250, 330 feet E line, 150 feet N line, location.

Henne, Winch & Fariss—Zapata County

Magnolia Petroleum Co.'s No. 4 F. G. Martinez, Survey 4, 660 feet S line, 660 feet E line of W half of survey, location.

Magnolia Petroleum Co.'s No. 5 Martinez, Survey 6, 660 feet S line, 660 feet E line of S line of Magnolia tract in NW of survey, location.

Magnolia-Cole—Webb County

Magnolia Petroleum Co.'s No. 1 F. Benavides, Survey 660, 660 feet N line, 660 feet E line of N half of SE of survey, location.

Magnolia Petroleum Co.'s No. 2 C. Benavides, Survey 662, 660 feet W line, 660 feet S line, derrick.

Magnolia Petroleum Co.'s No. 3 C. Benavides, Survey 662, 1,980 feet W line, 1,980 feet S line, location.

Magnolia Petroleum Co.'s No. 4 Brennan-Benavides, Mariano Arispe Grant, corner Blocks 16-17-52-53, Myrtle E. Hale Subdivision, location.

Cole Pool—Duval County

Magnolia Petroleum Co.'s No. 2 King-Benavides, Block 12, Survey 694, 450 feet N line, 150 feet W line, location.

Allied Gas Co.'s (Shell) No. 3 Dinn, Survey 143, 660 feet N line, 660 feet E line of NE of SE of survey. location.

J. G. Mackay's No. 3 Dinn, Survey 454, 660 feet W line, 660 feet N line of NW of SW, location.

DRILLING ACTIVITY

Buchanan—Caldwell County

Neuman & Speer Inc.'s No. 1 McConnell in the William Spillers Survey, 900 feet SW of The Texas Company's No. 1 Cude, total depth 1,945 feet, deepened and has some heavy oil in chalk.

Darst Field—Guadalupe County

Gulf Producing Co.'s No. 1 C. Anderson in the J. C. Darst Survey, 150 feet to S and E lines, location.

Gulf Producing Co.'s No. 1 Thomas Dix in the Joel R. Robinson Survey, 150 feet to the NE and SE lines of lease, 300 feet SW of United North & South's No. 1 Dix, location.

Darst Creek—Guadalupe County

Gulf Production Co.'s No. 1 Tadlock in the Jacob C. Darst Survey, 150 feet NW corner, location.

Magnolia Petroleum C.o's No. 1 Thomas Dix in the Joel R. Robinson Survey, 150 feet to SE line of lease, 150 feet NE of corner of Alexander Survey, total depth 180 feet, drilling.

Magnolia Petroleum Co.'s No. 2 Thomas Dix in the Joel R. Robinson Survey, offset to United North and South's No. 1 Dix, 150 feet to NW line of lease, 1,000 feet to NE line of lease, rigging up.

Magnolia Petroleum Co.'s No. 1 L. V. Echols in the James Hodges Survey, 150 feet to NW and SW lines of farm, 3,650 feet to SW, 3,220 feet to NW of survey, location.

Magnolia Petroleum Co.'s No. 2 L. V. Echols in the James Hodges, 150 feet to SW and SE lines of lease, derrick up.

Magnolia Petroleum Co.'s No. 1 Peter Klien in the Joel R. Robinson Survey, 150 feet to NE line of lease, 150 feet SW of SW line of Alexander Survey, rigging up.

Magnolia Petroleum Co.'s No. 1 Rand Miller in the Jerome B. Alexander Survey, 150 feet to NW and SW lines, total depth 2,621 feet, flowed 310 bbls. in 24 hours, now shut in.

Magnolia Petroleum Co.'s No. 1 C. Zedler in the James Hodge League, 150 feet to NW and NE lines of 100-acre tract,

one-hale mile S from Magnolia's No. 1 Appling (correction), derrick.

Mundine Investment Co.'s No. 1 L. V. Echols in the James Hodges Survey in 11-acre tract out of south point of L. V. Echols tract, 150 feet to NW and SW lines of tract, 3,650 feet to SW and 4,200 feet to NW lines of survey, total depth 2,550 feet. Drilling out plug. Bottom of hole in Eagleford.

The Texas Company's N.o 2 Dallas Wilson in the J. C. Darst Survey, 150 feet to S and W lines, derrick.

The Texas Company's No. 2 L. Anderson in the Jacob Darst Survey, 150 feet to N and E lines, total depth 685 feet, shut down.

The Texas Company's No. 3 L. Anderson in the Jacob Darst Survey, 150 feet to N and W lines, location corrected.

The Texas Company's No. 4 Lemmie Anderson in the J. C. Darst Survey, 150 feet to N and W lines of farm, derrick.

Trinity Drillers-Clements' No. 1 Rand Miller in the Jerome B. Alexander Survey, 150 feet to NW and NE lines of 25.5-acre tract, drilling in Del Rio Clay at 2,510 feet.

United North & South Development Co.'s No. 1 Thomas Dix in the Joel R. Robinson Survey, 150 feet to SE and SW lines of lease, total depth 2,547 feet, waiting for orders, set casing at 2,545 feet.

United North and South Development Co.'s No. 2 Thomas Dix in the Joel R. Robinson Survey, 150 feet to SE line of lease, 450 feet to SW line of lease, 300 feet NE of No. 1 Dix, moving in rig.

Lasater—Brooks County

Houston Oil Co. of Texas' No. 1 Holbein-Wormser in the Palo Blanco de Maguellas Survey, 330 feet N line, 6,540 feet E line, direct offset 660 feet S of No. 1 Lasater, drilling in gumbo at 1,920 feet.

Kingsville—Kleberg County

Humble Oil & Refining Co.'s No. 8 R. J. Kleberg, Lot 7, Section 40, K.T.&L. Survey, 150 feet S and E lines of lot, total depth 3,033 feet, trying to back up and complete as a dry gas well; tested sulphur water in 2,900-foot sand, bottom of hole drilled to 3.033 feet.

Cartwright—Live Oak County

Houston Oil Co.'s No. 2 J. B. Dunning in the M. B. Kilvin Survey, 1,445 feet N of No. 1, total depth 2,088 feet, resetting liner after bailing salt water.

Agua Dulce Field—Nueces County

Agua Dulce Oil & Gas Co. and Houston Gulf Gas Co.'s No. 1 Ollie Purl, 450 feet from S and W lines of N half Section 6, Ross Peters Subdivision, total depth 2,305 feet, tested small flow of gas, plugged back to 2,031 feet and set 6⅝-inch casing to top of sand, waiting for cement.

White Point—San Patricio County

Spencer & Rhodes' No. 2 Texas Company Fee, Lot 6, Roos Subdivision, 150 feet to S and W lines of W 50 acres, derrick partly built and standing.

Nursery Field—Victoria County

Humble Oil & Refining Co.'s 3-A Jay J. Welder in the D.L.&C. Survey, 1,634 feet SE lines, 736 feet SW lines, total depth 5,865 feet, drilling in shale.

Cole—Duval County

Allied Gas Co.'s No. 1 Dinn, Survey 143, 660 feet S line, 660 feet E line, total depth 1,744 feet; set 6⅝-inch casing at 1,735 feet; sand at 1,737-44 feet; tested gas through tester; bailing.

Allied Gas Co.'s No. 2 Dinn, Survey 665, 300 feet N line, 300 feet E line, drilling at 50 feet; set 10-inch casing at 45 feet.

Simms Oil Co.'s No. 7 Dinn, Survey 454, 660 feet W line, 660 feet N line of SW of NW, drilling at 1,600 feet.

Kohler—Duval County

Humble Oil & Refining Co.'s No. 37 Kohler, Survey 144, 330 feet to N line, 495 feet to E line, total depth 1,747 feet; bailed small amount oil; rigging pumping equipment.

Humble Oil & Refining Co.'s No. 1 Peters, Survey 398, 1,495 feet N line, 1,495 feet W line, drilling at 1,184 feet.

Schoolfield O-Byrne—Duval County

Magnolia Petroleum Co.'s No. 10 Hahl, Block 25, Survey 250, 30 feet E line, 150 feet S line, total depth 2,321 feet; waiting for power.

Magnolia Petroleum Co.'s No. 11 Hahl, Block 25, Survey 250, 330 feet E line, 150 feet S line; drilling at 1,218 feet; set 12½-inch casing at 38 feet.

Simpson Fell Oil Co.'s No. 7 Moody, Survey 60, 2,148 feet N line, 150 feet W line, drilling at 1,400 feet.

Trapshooter Reilly Oil & Royalty Co.'s No. 3 Hahl, Block 26, Survey 250, 30 feet E line, 150 feet N line, setting casing at 2,338 feet.

Randado Pool—Jim Hogg County

Randado Oil Corp.'s No. 35 Palacious, Block 2, Survey 291, 150 feet S line, 450 feet E line, standing at 100 feet.

Magnolia Petroleum Co.'s No. 1 N. Hinnant, Block 1, Survey 20, 600 feet N and W lines, total depth 2,992 feet, abandoned.

Magnolia Petroleum Co.'s No. 1 Weil, Block 2, Survey 5, 660 feet N line, 349 feet E line, location.

Henne-Winch-Fariss—Jim Hogg County

George S. Marshall's No. 4 Holbein, Block 10, Survey 11, Share 3, derrick.

George S. Marshall's No. 5 Holbein, Block 10, Survey 15, Share 3, 150 feet N and W lines; rigging up.

W. R. Shankle's No. 3 Holbein, Block 22, Clarkson & Carscaden Subdivision (Hogg Ridge), Share 3, Las Animas Grant, 150 feet W line, standing at 600 feet.

Aviator Field—Webb County

C. E. Mayberry's No. 9 Puig, Block 1, Edgingston Subdivision, Puig Ranch, Albercas Grant, 729 feet W line, 1,100 feet N line, drilling at 1,500 feet.

Carolina-Texas—Webb County

W. R. Shankle's No. 2 Webster, Survey, 684, 1,170 feet W line, 150 feet S line, rigging up.

Magnolia Cole—Webb County

Cole Petroleum Co.'s No. 67 Benavides, Block 4, Survey 412, 313 feet E line, 160 feet N line, total depth 2,357 feet; sand at 2,351-57 feet; testing through tester.

Magnolia Petroleum Co.'s No. 1 J. G. Valdez, Block 15, Survey 754, 150 feet S and W lines, total depth 1,475 feet; drilling, set 12½-inch casing at 42 feet.

Magnolia Petroleum Co.'s No. 1 D. Benavides, Block 14, Survey 694, 660 feet to E and S lines, derrick.

O. W. Killam's No. 15 Bruni, Survey 6, Mariano Arispe Grant, 150 feet SW line, 150 feet SE line of Survey 6, Adams Subdivision, Bruni Land, drilling at 50 feet, set 10-inch casing.

Cole Pool—Webb County

Magnolia Petroleum Co.'s No. 1 S. Perez, Survey 460, J. Poitevent, 1,980 feet N line, 660 feet W line, drilling at 2,730 feet.

Magnolia Petroleum Co.'s No. 2 King-Harper, Block 2, Survey 323, 660 feet N and E lines, location.

Houston Oil Co.'s No. 20-D Benavides, Block 5, Survey 753, 566 feet N line, 666 feet E line, total depth 2,351 feet; testing, set 6⅝-inch casing at 2,346 feet and at 2,346-51 feet.

John J. O'Hern's No. 2 Valdez, Block 6, Survey SW of NE of 754, 663 feet N line, 667 feet E line, total depth 2,324-51 feet; sand tested gas and oil through tester; set 6⅝-inch casing at 2,330 feet, waiting on cement.

Jennings Pool—Zapata County

Blair & Acklin's No. 2 Trevino, Block 1, Survey 66, 150 feet W line, 200 feet N line, drilling at 1,200 feet.

R. F. Blankenship's No. 1 Garza, Block 13, Survey 413, 160 feet N and E lines, resumed drilling at 1,510 feet.

Killam-Duggan's No. 10 Cuellar Survey 277, 2,095 feet W line, 1,890 feet S line, total depth 1,596 feet, completed for 150 bbls.

Killam-Duggan's No. 11 Cuellar, Cerrito Blanco Grant, 645 feet S Wline, 1,350 feet NW line of 886-a tract which is E half of 1,772-A Cuellar tract, Cerrito Blanco Grant; total depth 1,378 feet, rock at 1,377 feet, sand at 1,378 feet.

O. W. Killam's No. 17 Cuellar, 600 feet N line, 940 feet E line, 160-A Cuellar tract out of 1,772-A Cerrito Blanco Grant, derrick.

South Texas Production Co.'s No. 2 Roy Jennings, Cerrito Blanco Grant, 13,000 feet NW line, 9,800 feet SW line, drilling at 1,971 feet.

South Texas Prod. Co.'s No. 7 Joe Jennings, Cerrito Blanco Grant, 640 feet SE line, 660 feet NE line, spudded in.

South Texas Production Co.'s No. 8 Joe Jennings, Cerrito Blanco Grant, 2,640 feet SE line, 2,660 feet NE line, rigging up rotary.

LA.-ARK. FIELDS

(Continued from Page 70)

tion 33-23-9, Shongaloo district, was completed as a 10-bbl. producer at 2,692 feet making 90 bbls. of water along with the oil. This locality is producing from four wells all of which have made salt water along with the oil. The same company's No. 1 Scroggins in Section 1-22-11. Sarepta district, across the parish to the west from the Shongaloo wells, pumped 390 bbls. fluid, 50 per cent oil, from 2,708 feet. Ohio Oil Co.'s No. 45 Bodcaw, Section 21-21-10, Cotton Valley, gauged 18,707,000 feet of gas at 1,090 pounds from the deep sand at 4,713 feet.

A half dozen old gas wells in the Carterville district of Bossier Parish, west of the Sarepta district in Webster, have been taken over by other interests and will be deepened for the oil tapped by Sales & Walker's No. 1 Kilgore, Section 31-23-11, at 3,155 feet. They appear on the report this week as rigging up to deepen but will not be until their gas production has shrunk below commercial proportions. Average depth of the gas runs around 3,000-3,100 feet, most of the wells producing from close to 3,000. The Sales & Walker well, completed October 28 with an initial of 180 bbls., is still performing at the same rate and was the beginning of the rising spirits that have prevailed in this territory for the past month. Woodmansee and others' No. 1 Bollinger, Section 9-22-11, shut down at 3,532 feet last May, missed production entirely and this week was written off as a dry hole. In the Elm Grove gas district of Bossier Palmer Corp. completed No. 12 Caplis, Section 25-16-12, as a 6,000,000-foot well, total depth 1,885 feet.

Dixie District

Dixie district of Caddo Parish is still in eclipse with Ohio Oil Co.'s No. 6 Hunter, Section 17-19-14, abandoned as a salt water hole at 2,482 feet. Woodley Petroleum Co.'s wildcat in the southeast corner of Township 16-12, in the Caspiana extension of the Elm Grove gas area, was finished making 3,000,000 feet of gas fom 2,450 feet. Louisiana Oil Refining Cop. abandoned its Caldwell Parish wildcat, No. 1 Louisiana Central Lumber Co., Section 31-12-3e, as a salt water test at 1,558 feet after coring the Urania pay at 1,512 feet and finding it dry and a salt water sand from 1,521 feet to total depth.

R. W. Norton is figuring on another test of No. 1 Hill, Section 33-23-16, Caddo Parish, of the sand at around 4,100 feet tested dry in No. 1 Fortner, drilled by himself and Humble Oil & Refining Co. in Section 32-23-16, last spring and finally abandoned at 5,002 feet. He had sand, reported saturated, from 3,685-3,701 feet and everyone expected a well but did not test until 3,727 feet and then got salt water. The core he took at the previous depth was thought to be the same that Magnolia Petroleum Co. cored in its McCook & Hibbler well in Cotton Valley

White Sulphur district of LaSalle Parish, 20 miles or so southeast of Urania production, is the setting for a new location by Tonica Petroleum Co., which has a half dozen or so small producers from a stray shallow sand at around 800 feet, for No. 52 L.&A. in Section 17-7-2e.

Monroe District

Monroe gas district reported only two completions during the week though deep tests in that area retain considerable interest, as is the case in the northeast corner of Richland proven area. Amalgamated Carbon Co.'s No. 3 Cole, Section 42-19-4, completed November 25, made 5,274,000 feet of gas from 2,112 feet and No. 1 H. M. Jones of Lyons Gas Co., Section 11-20-3, gauged 4,684,000 feet at 950 pounds, total depth 2,179 feet. Two wells were finished in the Richland Field, Arkansas Louisiana Pipe Line Co.'s No. 1 Chenault, Section 2-16-16, in the northeast corner and a semiwildcat gauged 61,938,000 feet at 800 pounds, total depth 2,430 feet. Palmer Corp.'s No. 4 Rhymes, Section 28-17-6, plugged back from 3,127 feet after missing the 2,900-foot tapped by Hope Producing Co. with No. 1 Eubanks in Section 26-17-6, and was finished at 2,448 feet making 632,000 feet of gas at 800 pounds. On the original test in the shallow sand it was listed as dry at this same depth.

Three deep tests are going in the Monroe district. J. L. Bullock, trustee, (S. D. Hunter estate) No. 1 West Virginia Timber Co., Section 25-18-5, Ouachita Parish, cemented 9-inch at 2,303 feet, total depth 2,338 feet, the location being about half-way between Monroe and Richland proven areas, without having found the Monroe gas at 2,100-2,200 feet, or found the Richland rising. Magnolia Petroleum Co.'s No. 4 United States Government, Section 20-19-5, Ouachita Parish, almost in the heart of the Monroe Field as a whole, was dry at 2,250 feet, tested 1,000,000 feet of gas at 2,509 feet and half of that at 2,528 feet; plugged back to 2,290 feet and got still less and is shut down for orders. Palmer Corp.'s No. 1 Cagle, Section 7-18-5, Ouachita Parish, cemented 6⅝-inch at 2,167 feet in case it might get the Monroe gas, did not get it, cemented 4½-inch at 2,381 feet and tested salt water at 2,386 feet and on last report was drilling red shale at 2,455 feet. Southern Carbon Co.'s No. 54 Fee, Section 13-19-4, Ouachita Parish, tested 500,000 feet of gas at 2,195 feet and drilled to 2,631 feet without any further showings and is arranging to plug back and test the Monroe horizon again. Palmer Corp.'s No. 1 Eubanks, Section 26-17-6, Richland Parish, was dry at 2,951 feet, 9 feet below where Hope Producing Co.'s No. 1 Eubanks in the same section was coring lime and red shale at 2,970 feet. The Hope well, a 51,000,000-foot producer, is 3,288 feet west and 1,980 feet south of the NE cor. and the Palmer's 1,100 feet north and 350 feet east of the SW cor. SE NW. Ten wells in Richland set 6-inch this week at the uniform depth of 2,300 feet.

ARKANSAS

There was little of interest from Arkansas. Talbot & Markland abandoned their deep test in Section 31-19-19, Columbia County, 5 or 6 miles northeast of Haynesville production across the line in Louisiana, at 4,509 feet. They topped the Blossom at 2,966 feet but the hole was dry all the way down, finding nothing to warrant even a drill stem test. In Miller County E. V. Lenz abandoned No. 1 Persons, Section 13-15-26 at 3,362 feet as a dry hole. The effort was not without its success, however, if his claims are right, for he declares he has definitely located a fault on which he places great stress as an augury for future success and straightway leased a new block of 7,000 acres. He was assisted in this well, the latest of a series of seven or eight in Miller County, by Arkansas Natural Gas Corp. and Standard Oil Co. of Louisiana, and is busy financing another test. His wells, and others, have proved the existence of the greatest sand body found anywhere in the Shreveport division, but the sad fact that its more than 300 feet has been consistently barren, except for one show, remains. This one show was claimed in No. 2 Dale, Section 23-15-26 at 3,055 feet, but the test resulted in salt water.

Further drilling of the shallow area in Smackover resulted in a 54-bbl. producer for Standard Oil Co.'s No. 8 Powell, Section 34-15-15, Ouachita County, and 40 bbls. in No. 4 E. Johnson, Section 34-15-15, for the Simms Oil Co. Arkansas Drilling Co.'s wildcat in Section 17-18-12, No. 1 Norris, was a dry hole at 3,400 feet.

Lawson-Urbana Area

Territory southwest of the Lawson-Urbana gas area that proved a flash in the pan two years ago because of too closely associated gas and water, is attractive to at least two operators. Joe Modisette and others have derrick up for

No. 1 Union Sawmill in Section 14-18-14 and Oil Well Corp. has a derrick on location for No. 1 Union Sawmill in Section 10-19-14. There has been just enough oil in possibly a dozen wells drilled in this general locality to tease operators—among them Jimmy Garrett, Modisette's associate, Humble Oil & Refining Co., H. L. Hunt, and others—into drilling "one more hole."

Drilling activity in north Arkansas, or more properly, the Arkansas River Valley, is picking up, and two wells in Washington County on the north edge of the slope that have been shut down for some time have been revived as the Arkansas drilling report will show.

Sabine Parish's new field, Zwolle, makes its appearance as a separate, or independent, producing district with this week's production report. Heretofore oil from R. L. Gay's four wells in that area have been included in Pleasant Hill runs, or not reported at all, but when Gay's last well, the big gusher that is lifting this district out of the dumps, came in the listing was changed and the area is credited with 2,000 bbls. daily avergae. How it gets that way is not quite clear unless storage is being heavily drawn upon to make way for oil from the new well to which a 4-inch line will be completed next week. The three old producers in the district, grown as they have, are not running more than 500 bbls. into field storage, if that much.

Daily Average Runs

Daily average runs for the week totaled 100,400 bbls., 37,400 from north Louisiana district and 63,000 from Arkansas. Runs from the several pools were:

NORTH LOUISIANA	
Caddo, light	10,270
Caddo, heavy	2,935
Homer	3,725
Haynesville	4,815
DeSoto-Red River	3,000
Elm Grove	545
Bellevue	630
Cotton Valley	2,500
Urania	5,510
Pleasant Hill	320
Sarepta	650
Zwolle	2,000
Total	37,400
ARKANSAS	
El Dorado	4,300
Smackover, light	5,790
Smackover, heavy	44,335
Stephens	1,020
Nevada County	1,080
Lisbon	1,150
Champagnolle	5,240
Gladley	85
Total	63,000
Both states	100,400
Last week	100,390
Difference	10

CANADIAN FIELDS

(Continued from Page 77)

Calmont's No. 12, same LSD, is reported working on derrick.

Mercury Oils' No. 4, LSD 2, Section 4-19-2w5, has derrick up. Mercury's No. 5, LSD 2, Section 4-18-2w5, is spudding in.

Vanberta Oils' No. 2, LSD 5, Section 34-18-2w5, has started work on acreage of Rand Petroleums, Ltd., in the extreme south of the field. Acreage lies between the Sterling Pacific and Merland wells. Derrick is going up to spud in early in December. Vanberta Oils, Ltd., has contracted to drill four wells on this acreage. Vanberta's No. 1 was started this summer on the Black Diamond structure in the north end of Turner Valley, but is temporarily shut down till the effects of faulting on that structure are determined. Vanberta Oils, Ltd., officers are: president, W. S. Burley; vice president, William Johnson; secretary, C. C. Bell; field manager, R. J. McLean, all of Vancouver; director, J. W. Bawden, Lethbridge, Alberta.

Askalta Oils' No. 1, LSD 16, Section 5-19-2w5, is working on derrick.

Central Turner Valley

In the Central Turner Valley area, McLeod Oil Co.'s No. 1, LSD 16, Section 1-20-3w5, is fishing for lost bit; the well is blowing wet gas and making up to 45 bbls. crude naphtha.

Okalta Oils' No. 1, LSD 1, Section 1-20-3w5, has blown back into production after being frozen off. Normal production is around 300 bbls. Widney Petroleums' No. 1, LSD 11, Section 12-20-3w5, is reported pumping 125 bbls. 54 gravity crude from the McDougall-Segur sand at 3,250 feet. New McDougall-Segur Oil Co.'s No. 3, LSD 14, same section, recently resumed drilling in the Kootenays at 3,380 feet after standing cemented over a year. About 500 feet of oil was found standing in the hole. A production test is being made.

It is reported that Outwest Petroleums, Ltd., whose No. 1 test on the Black Diamond structure, LSD 5, Section 35-19-3w5, is shut down at 3,700 feet, is arranging to start its No. 2 test on the Mercury Oils, Ltd., holdings in Section 4-19-2w5, in the South Turner Valley.

Waite Valley Structure

Richfield Petroleums' No. 1, Section 35-20-3w5, is drilling at 3,480 feet after striking a show of light green crude. Sharron Oils' No. 1, LSD 7, Section 5-20-3w5, is rigging up. Cartier Oils' No. 1, LSD 10, same section, is working on derrick. Brock Petroleums' No. 1, LSD 2, Section 35-21-4w5, is drilling at 2,460 feet after getting a fair show of gas in the lower Bentons. Harland Petroleums' No. 1, LSD 14, Section 6-20-3w5, is erecting camp buildings.

Highwood-Sinclair Structure

On the Highwood-Sinclair structure, the Hudson's Bay Oil & Gas Co.'s No. 1, Section 8-18-3w5, is attracting some attention. This test started drilling in the lower Blairmore-Dakota and reached the Fernie shales at the shallow depth of 950 feet, when a flow of gas, estimated 2,000,000 feet, was struck. This gas is being used as fuel. The well is now drilling at 1,125 feet and nearing the Dalhousie sands. Northwest-C. & E.'s No. 1 is drilling at 467 feet. This test is being drilled by Imperial Oil, Ltd., which some time ago abandoned its Highwood No. 1 on another portion of the structure after drilling into a fault, where the Fernie shales recurred below the deep lime.

Drilling in Foothills

In the foothills of western Alberta, drilling operations are being carried on in a number of areas, somewhat handicapped by winter. In the Morley Reserve area, Wabash Oils' No. 1 has encountered additional wet gas production in the Devonian lime at 2,974 feet, and is drilling deeper, with gas gradually increasing. On the Moose Dome, Moose Oils' No. 1, LSD 16, Section 29-22-6w5, is drilling at 1,060 feet in a hard band between the upper and lower Devonian, after getting several gas pockets.

Bearberry Oil & Refining Co. has completed its season's preliminary work on acreage leased in the Castor, Bearberry Creek, Parker and Brazeau areas. The company holds some 13,000 acres and additional filing will be done in the spring. No. 1 has been tentatively located in Section 18-33-7w5.

In the southern foothills, Patrick Oil, Ltd., is being incorporated to handle the proposed development, on the old Lineham oil properties west of Waterton Lakes where 28 years ago the Rocky Mountain Development Co. brought in a well reputed to show an initial of 300 bbls. of light crude. Officers included John Lineham, A. P. Patrick and George K. Leeson. L. P. Patrick and W. F. Spence are heading a syndicate which holds the 100-acre lease on which the old Lineham well was located in NE Section 30-1-30w4.

In the Lomond district, Hudson's Bay Oil & Gas Co.'s Lomond No. 2, Section 23-17-18w4, is drilling at 125 feet.

In the Skiff Field, Dauntless Oils' No. 1, LSD 9, Section 36-6-15w4, is reported testing production. The test encountered 30 feet heavy saturation, and cores from the Sunburst sand showed a higher gravity crude than met in the Devenish discovery.

In the Chin Coulee area, Chinalta Petroleums' No. 1, LSD 5, Section 33-8-18w4, is changing to standard equipment and will resume at around 2,200 feet. The test was carried to this depth last year by Lethalta Oils, Ltd., of Edmonton, and is being completed by Chinalta Petroleums under an arrangement which enables the latter to take over 7,400 acres immediately on completion. In Lethalta Oils' drilling traces of oil and gas were met at 2,066 feet, with additional small oil shows in the lower horizons.

In the Champion district, Hudson's Bay Oil & Gas Co.'s Champion No. 1, LSD 2, Section 9-16-23w4, has been abandoned owing to caving and water trouble below 2,800 feet. Drilling was done by the Alberta Gas & Fuel Co., a Doherty subsidiary, under an arrangement originally made with the Hudson's Bay Marland Oil Co. It is reported that a second test will be started in the spring.

In the northern section of the Blood Reserve area, Commonwealth Petroleums, Ltd., has put down 11 core drill tests.

In the Pincher Creek area, Weymarn Petroleums' No. 2 is building derrick.

Wainwright Field

In the Wainwright Field, east central Alberta, Wainwell Oils' No. 1, LSD 9, Section 36-44-7w4, has been cemented and bridged back from 2,215 feet, where the lower sand was encountered, to 2,072. A 24-hour test on the pump is reported to have given 177 bbls. of crude without water. No sand trouble was reported. This test originally got production in the upper sand, with a flush production estimated at 360 bbls. It was deepened to the lower sand, when sanding and water trouble developed, and it was decided to cement back. A production line and steam lines are being run from No. 1 to Wainwell Oils' refinery and Nos. 1 and 4 will be put on a steady pumping production basis. No. 4 is reported making up to 50 bbls. A number of wells in the Wainwright Field have had water trouble through drilling a little too deep and hitting the water below the oil sand; and it is thought some of these may be successfully cemented back and restored to production.

Oil Selections' No. 1, LSD 13, Section 2-46-7w4, has derrick finished. Senator Oil & Gas Development Co.'s No. 1, east half Section 23-44-6w4, is drilling below 185 feet after encountering two gas pockets aggregating 400,000 feet. British-Wainwright Oils' No. 1, LSD 13, Section 22-45-6w4, is being put in shape to pump, after standing idle a considerable time. Wainwright Petroleums' No. 1, LSD 6, Section 30-45-6w4, is coring below 2,190 feet and close to the oil sand. It is reported that Duluth Syndicate's No. 2 will be drilled between Minburn and Kinsella, testing a structure extending southeast from Birch Lake to the Wainwright Field.

Edalta Oils' No. 1, LSD 15, Section 19-45-6w4, tested a sand at 2,183 feet, finding some oil but considerable water. The test will be carried to around 2,300 feet.

Saskatchewan

In eastern Saskatchewan, Citizens Oil & Gas Co.'s No. 2, Section 14-41-24w3, is drilling at 1,900 feet.

The Riverhurst district in Saskatchewan is receiving considerable attention. A couple of years ago a local organization, the Riverhurst Oil & Gas Co., put down two shallow tests to 518 and 528 feet. Some gas was struck in both, estimated around 500,000 feet. A well drilled by Charles Olman is reported to have got a show of oil just below 500 feet. Prudential Oil Co., a new organization, has taken over the Riverhurst company's holdings and the Olman well, and is preparing for development in the spring. The Vermilion Hills Oil & Gas Syndicate, headed by W. Richardson, has been formed by Riverhurst men to drill south of the town; the syndicate has around 600 acres, and will start a test early next season. A Winnipeg syndicate has leased acreage northeast of Riverhurst and will also start development next spring.

British Columbia

In British Columbia, the Akamina Valley Oil Co. has started on derrick but decided to shut down until spring. The location is on the British Columbia side of Waterton Lakes Park.

Manitoba

In Manitoba, the Dauphin Syndicate, drilling in the Dauphin district, is reported 200 feet in the lime at 885 feet depth and running 6-inch casing. Some further small shows of crude have been reported. Some years ago commercial crude was reported in a shallow test near Dauphin, but it failed to prove up.

Ontario

In the Dover Field, Kent County, Ontario, Olga Oil & Gas Co.'s No. 1 is reported drilling 113 feet in the Trenton at 3,003 feet depth. Olga's No. 2 is drilling at 1,170 feet. Ajax Oil & Gas Co.'s No. 6 is reported preparing for a shot in the Trenton. Acme Gas & Oil Co.'s No. 2 is drilling.

In Moore Township, Lambton County, Western Salt Co.'s test for gas near Courtright is reported drilling in the Trenton limestone around 4,100 feet. In concession 1, Moore Township, the Leo Wilson Syndicate's No. 1 test is reported drilling in the Trenton.

CALIFORNIA FIELDS

(Continued from Page 80)

Nos. 6 and 11 in Section 22-28-27. Production, however, is still going full blast on the Kern front as operators have not yet ratified a definite basis for a reduction.

The Standard Oil Co. has reached 8,195 feet in No. 27 K.C.L., a deep test in the Elk Hills Field of Kern County. This well, in the extreme eastern end of the Tupman area in Section 31-30-25, is in a hard sandy shale with no important showings. At Wheeler Ridge, the Standard's deep test in Section 28-11-30 has reached 6,380 feet, the prevailing formation being a hard sand. The Belridge Oil Co., working on a deep test in the Belridge Field of Kern County, is testing the water shut off in No. 15, in Section 26-27-20. This well is bottomed at 5,060 feet with a string of 6⅝-inch landed at 4,950 feet. The General Petroleum is making preparations to resume production on its lease No. 2 at Lost Hills about January 1. This will affect approximately 75 wells shut in for several years. Several crews are already at work cleaning out these old producers. These wells will boost the company's production about 2,000 bbls. a day. The General Petroleum is not especially anxious to put these wells back on production but finds it necessary to have sufficient oil available for blending purposes. The General Petroleum has a small pipe line running from Kettleman Hills to Lost Hills. It is the present intention to run its Kettleman Hills production over to Lost Hills where it will be blended with crude oil from the latter area.

Tideland Drilling

Tideland drilling out in the open ocean, which has been limited to development work in proven fields, is soon to occupy a prominent position in wildcat exploration. The Continental Oil Co. is making preparations to drill its third test well at Carpenteria on a tideland drilling permit, No. 124, and George F. Getty has already petitioned the United States war department for permission to follow a similar procedure a short distance west of the Continental's new wildcat. The General Petroleum is making preparations to start five tests on as many tideland permits at Goleta in Santa Barbara County. These tests will be drilled on permits fronting on the More Ranch at Goleta where the company's first wildcat No. 1 More blew in doing around 50,000,000 feet of natural gas daily from 4,533 feet. No. 2 More, the General Petroleum's second test at Goleta, is correlating very closely with the original wildcat and company officials are naturally hopeful of success. Piles are at present being driven for No. 1 Bank, No. 1 Sands and No. 1 Parker and present plans also contemplate immediate drilling on the Crandall and Jomes permits. The Oakburn Petroleum Co., a subsidiary of the Bankline Oil Co., is another concern anticipating tideland drilling and work on its first project is scheduled to get under way shortly. This test will be drilled on a pier at Capital where the General Petroleum recently discovered a new oil field within throwing distance of the surf.

Practical Suggestions in Refining

By W. T. Ziegenhain

Control of Vacuum Accomplished by Use Of Simple Apparatus

A simple method of maintaining a constant vacuum during a laboratory distillation of oil has been developed and found useful in the government's laboratories in Washington by Ward E. Kuentzel. The apparatus utilizes the action of an electric magnetic circuit in opening and closing a relief valve in the vacuum system.

The apparatus has been in successful operation for several months and the only failure during its continuous operation in that time was traceable to the weakening of the battery.

The essential features of the apparatus are shown in Figure 1. The mercury in

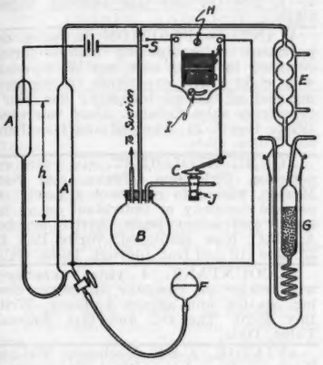


Fig. 1.

the manometer AA is adjusted by means of the leveling bottle F to such a position that when contact is broken with the platinum wire sealed into the closed arm A, the heighth corresponds to the degree of vacuum desired. Upon closing the electrical switch S, current flows from a 6-volt storage battery through the magnet coils of an ordinary doorbell buzzer, the terminals of which are connected directly to the binding posts so that the vibrator operates like the armature of a relay. The extended armature is attached at right angles to an extension of the stopcock handle in such a way that magnetization of the coils closes the stopcock C, allowing gas to be withdrawn from the condenser E and boiling tube G by means of the service vacuum or any other suitable source of suction. When the pressure in the system falls below the heighth, the electrical circuit is broken, the armature is released and the stopcock opens by spring action of the relay. The influx of the air then increases the pressure until the electrical circuit is again closed, when the cycle is repeated. The manometer AA is constructed of two wide tubes connected by a narrow tube to minimize surges.

An essential feature of the automatically operated stopcock is the attachment of a short glass tube J to the small end of the stopcock barrel with cement. This tube is slightly tapered and is fitted with a small cork which presses against the end of the stopcock plug to prevent the latter from settling tightly into the barrel. The stopcock is lubricated thoroughly with vaseline or a light stopcock grease. The stopcock handle may easily be extended by sealing a piece of 3-mm. diameter glass rod or tubing to it with cement. A 3 or 4-liter flask B in the system serves as capacity to minimize surges. The pressure as observed on an open manometer attached to the system was constant to within less than 1 mm. of mercury at all pressures rang-

(Continued on Page 278)

FILTER PACKED WITH HAIR FELT AND COTTON REMOVES FINE EARTH

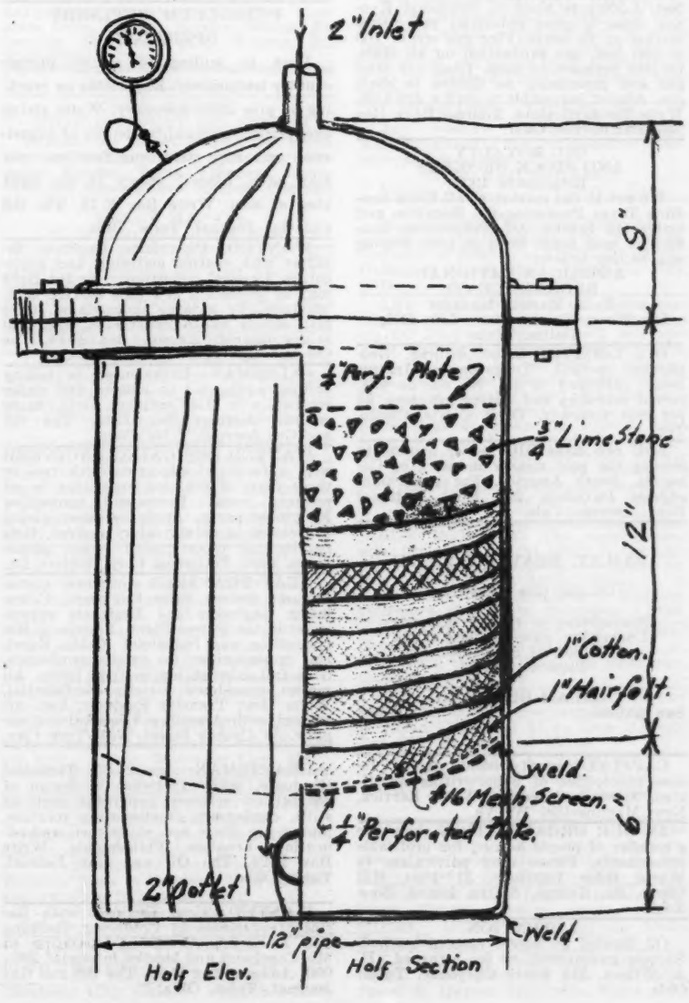
A small filter made from a short length of 12-inch pipe, packed with layers of cotton and hair felt has been found very effective in removing traces of fine earth from finished lubricating oils. The filter was designed at the Pierce Petroleum Corp.'s refinery at Sand Springs, Okla., for use in emergencies but could be given a more general use.

The accompanying sketch shows the construction of the filter. The main section is a piece of 12-inch pipe, 18 inches long. One end of the pipe was shut with a blank plate welded in place. Half of a flange union was welded to the other end. Inside this section and about 6 inches above the closed end, a quarter inch perforated plate was welded firmly to the sides to give the effect of a strainer. This forms a shallow compartment in the base of the pipe section. A 2-inch hole was drilled through the side of the pipe and into this compartment as an outlet. Connection is made by welding on a pipe fitting to best suit the purpose.

The top part of the filter is made by welding the other half of the steel flanged union to a 12-inch swaged nipple. A 2-inch hole drilled or burned through the center of the nipple supplies an inlet for the filter and a suitable pipe connection is welded in place at this point. The nipple is also drilled and tapped to take a small pipe leading to a pressure gauge. This gauge registers an increase in pressure as the filter becomes clogged with the fine earth. The stream coming from the filter also serves to indicate the condition of the filter.

Operation of Filter

The filter as built will easily stand 300 pounds pressure but the operator will usually find it advantageous to dump the filter and repack it before the pressure needed to carry on the filtering reaches that high. In packing the filter, a 16 mesh screen is first placed over the perforated iron plate in the bottom. Then a layer of ordinary hair felt, such as used for insulation, is placed over the screen. Then a layer of cotton is placed over the hair felt. Each is about 1 inch thick when pressed down with the hands. Three more layers of hair felt and two of cotton are alternately packed into the filter. The purpose of placing the two filtering materials in alternating layers is to eliminate channeling as far as possible. The top layer of hair felt is covered with 3 to 4 inches of three-fourth inch limestone. This acts to divide the stream of oil coming into the filter and protects the layer of hair felt. As an additional protection against washing a cavity in the rock and packing, a one-fourth inch perforated plate is laid over the rock layer.



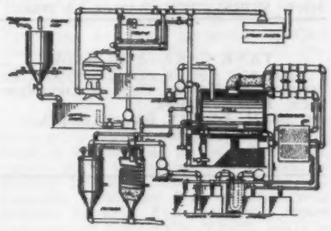
This type of filter has been in use at the Pierce refinery for several months but no special effort has been made to determine how often it should be repacked under the various conditions. However, since the function of the filter is to remove only the cloud or traces of fine earth remaining in the oil after being processed through the regular filters and after it has had a chance to settle in storage, the filter may be expected to easily handle several thousand barrels with each repacking. At present it is successfully handling 50 bbls. of 200 viscosity oil per hour at a pressure of 175 pounds.

Recent Patents

RECLAIM OIL

1,735,440. Art of Reclaiming Lubricating Oils. Oliver J. Nelson, St. Louis, Mo., assignor to Bryte-Nelson Refining Co., St. Louis Mo., a corporation of Missouri. Filed January 8, 1923. Serial No. 611,308. 7 Claims. (Cl. 196—16.)

2. In the art of reclaiming used mineral lubricating oil containing solid matter, moisture and lighter hydrocarbons,



and partially emulsified and polymerized, the process comprising, defecating the oil to clear the same of the solid matter and entrained water, gradually heating the defecated oil to the vaporizing point to the mineral lubricant base for a period sufficient to volatilize the remaining moisture and lighter hydrocarbons, blowing the oil body while being so heated, first with air and then with steam, and filtering the residue.

VAPOR PHASE REFINING

1,736,022. Art of Refining Hydrocarbons. Thomas De Colon Tifft, Chicago, Ill., and Arnold C. Vobach, Whiting, Ind., assignors to Sinclair Refining Co., New York, N. Y., a corporation of Maine. Filed February 10, 1928. Serial No. 253,365. 3 Claims. (Cl. 196—96.)

1. In the vapor phase refining of hydrocarbons by passage of the hydrocarbon vapors through a charge of an adsorptive catalyst, the improvement which comprises subjecting the hydrocarbon vapors first to a fractionating operation and therein condensing higher boiling constituents from the hydrocarbon vapors, subjecting the remaining hydrocarbon vapors to a refining operation by passing them as vapors in contact with an adsorptive catalyst, condensing vapors escaping uncondensed from the refining operation, separately discharging liquefied higher boiling material produced in the refining operation therefrom, and stripping lower boiling constituents from this higher boiling material by heat exchange with condensate discharged from the fractionating operation first mentioned.

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DRAFTSMAN. Age 26-35, Technical Graduate, with experience in design of general oil refinery apparatus such as stills, condensers, fractionating columns, piping, etc. State age, experience, and education. Location, Philadelphia. Write Box E-24, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Civil Engineer with Refinery experience by Producing, Refining and Marketing Company, operating in Mid-Continent and located in city of 100,000. Address Box E-23, The Oil and Gas Journal, Tulsa, Okla.

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Furnace and Fuel Oils Chicago Feature

Prices Firmly Held on Furnace Oils. Zero Gas Oils in Better Demand. Gasoline Market Was Very Quiet Monday

By J. B. Waldo

CHICAGO, Dec. 2.—The continued cold weather has brought an active demand for furnace oils and for the heavy fuel oils. There were many orders received today and buyers who had ordered last week were urging haste in deliveries. There was an active inquiry for cars in transit. The orders were from all parts of the territory and usually for not large quantities. Many of the orders were against contracts and some of the holders of these contracts gave instructions for their quotas over the month.

Prices were firmly held on furnace oils and a few sellers are now asking a full 4 cents for their distillate but others are selling good material at 3⅞ cents. Zero gas oils were in better demand than distillates and at full prices. Gas makers oil was quiet and not as strong as the zero oil. The heavy fuel oils were in active request and the movement on contracts was notably large but spot buyers were placing their orders for their December requirements. There is a growing scarcity of the zero grades of the 18-20 and the 28-30 oil and offerings are very light on these grades. A return of mild weather might cause some offerings of cars on the tracks for the buying is heavy and continued use of the oil will be required to prevent some accumulation.

Gasoline Market Quiet

The gasoline market was very quiet on Monday and devoid of any real feature. No prices changes were noted for the close of the preceding week. Kerosene was being very freely offered by refiners who were seeking business at 4⅛ cents. There was very little demand. In fact the only activity was in fuel and furnace oils at the opening of the week.

Demand Quiet

In spite of the good road conditions and other causes contributing to consumption of gasoline, for the season of the year, the demand in this market was quiet last week. Spot buyers were buying for immediate needs only and as some sellers claim, holding their spot orders until they could see the bottom of their tanks. Regular customers with contracts were giving their shipping instructions in a good fashion but there were some who were holding back a little, possibly buying an occasional car or two in the spot market. The kind of gasoline wanted was for the most part the regular U. S. Motor grade but there was some better demand for the higher gravities. The special antiknock gasolines were moving largely with Ethyl Gasoline, either with or without some prefix to indicate the refiner, gradually increasing in volume of sales. Some refiners who have adopted the blending of Ethyl and prefixed or added that name to the brand formerly used to indicate their antiknock product, have stated they did this because of the popularity which extensive advertising had given to the brand.

Members of two refining organizations have stated a great deal depends on the quantity of the fluid added to the white gasoline, if the blended product is to be profitable to them even at 3 cents higher than the original white gasoline. Some of the gasolines used for blending require much less than others. The usual quantity is three cubic centimeters per gallon. If the quality of the gasoline is such that less than the 3 cc. gives the required antiknock value the refiner is fortunate. If more is needed he is out of luck. Suggestion was made that a "shot" of natural gasoline often helped or might in some cases, depending largely on the crude and the regular gasoline that was produced for blending for only a certain grade of gasoline is equal to the requirements of the license under which the refiner who blends the Ethyl Gasoline acts.

Market Situation

There was very little change in the tone of the market or of prices during last week. The situation had been unsettled as to certain parts of the territory through the action of one Illinois refiner who offered a considerable quantity of U. S. Motor gasoline for sale at what was only a small reduction under the regular price. This refinery has not had any of its U. S. Motor fuel to sell for some time and has on several occasions during the summer been a buyer of gasoline. The location of the refinery gave it certain definite freight advantages to parts of Ohio, Indiana and Michigan and the result was jobbers in the differential territory had distinctly bargain prices offered to them when the prices were compared with the net back to the Group 3 refiner. In the territory in which the gasoline was moved the net back to the Group 3 refiner would have been between 6 and 6¼ cents, while the refiner who made the sales received around 2 cents a gallon more than this rate or close to 7¾ cents. The real effect on the market comes from the fact that this gasoline will displace the product of other refiners who would have had the business if the seller had not come on the market. Quite a number of jobbers in the parts of the states mentioned have supplied themselves with a stock of high grade motor fuel which will take them out of the market for some time.

The undertone of the market was firmer than many believed. There seemed to be a feeling that the bottom had been reached and that it would hold at around present prices. The menace, if there is a menace, lies in the possibility of other refiners deciding to turn their inventories into cash before the first of the year, and the problem seems to be more financial than that of marketing the gasoline.

Spot Market

The spot market last week for U. S. Motor gasoline was, according to the major refiners, 7¼ cents. They made no change and stated their spot business was light. Other sources of supply quoted 6¾ to 7 cents with the major part of the business going at 6¾ cents.

There was some selling at 6⅝ cents:, mostly direct or through brokers who charge $5 a car for making the purchase so that those who bought through these brokers paid nearly 6¾ cents a gallon, Group 3, for their gasoline. The lower priced gasoline which was offered the week previous for certain sections had been closed out and there was less talk of lower prices. Marketers found it impossible to buy good material at less than 6½ cents Group 3, and some refiners were not willing to meet that price. The Group refiners were reported as making real cuts in their crude runs and reducing their output to the present demand which should have a considerable result in stabilizing the market.

The higher gravities were in somewhat better demand but prices were not changed. One leading refiner has made a price of 7¾ cents for his very good 64-66 375 endpoint gasoline. The favored grade in the higher tests was the 60-62 400 endpoint. Natural gasoline was as usual in this market rather quiet. Some West Texas naphthas were offered for blending with little success as the jobbers were not blending to any great extent. The situation to the east continues to reflect extreme competition. In Ohio one of the older Group 3 refiners who formerly had a large trade in that state and even during the current year has had some contracts has closed out the last of these and is out of the State of Ohio. The reason for this move was it was found impossible to compete with the other refining sections and the local refiners in that State.

Kerosene Freely Offered

Kerosene is still being offered with much freedom and without much regard to the cost by some refiners who have more than they want to carry over. The tractor season was brought to an end by the early zero weather. Ohio refiners offered their kerosene freely and some guaranteed their 41-43 kerosene would run better than 42 gravity and it has been sold as 42-44 gravity, having a low endpoint and passing the doctor and corrosion tests. Apparently the refiner who does not have more kerosene in his storage than he would like to hold, is the rare exception.

Distillates Moving

Distillates are reported by local distributors as moving well to consumers but so far the demand has been supplied from stocks on hand and there has been only a moderate jobber demand. Local distributors and the larger distributors in many of the chief points of consumption bought freely early in the season and some have been receiving tank cars more rapidly than they could move the distillate. The chief users of distillates are the older style of burners, although last season quite a few burners of the smaller type were installed which were intended to use distillate as fuel. With the improvement in the domestic oil burner, the need for a fuel oil with a gravity higher than 32-36 degrees is passing and it will be only a matter of time when the sale of distillates for domestic oil burners will begin to grow less rather than larger. The market has been given a somewhat firmer tone by the cold weather which promises that very shortly there will be a larger demand on the refiners as the greater use of the fuel continues until those distributors who are well supplied are forced into the market for a replacement of stocks. There was a lot of this buying last week but it was, as a rule, from the smaller class of dealers and for single cars or a couple of cars at most. Many orders were wanted in a rush and some asked for deliveries of cars in transit if possible. Some demand came from tank car brokers who may have been holding orders until they were needed, hoping for a lower price and more profit. During the greater part of last week a good 38-40 distillate was selling at 3¾ to 4 cents, the latter price being for a really superior quality. But there was a distinct tendency to hold for better prices as the cold wave swept over this territory.

Gas Oils Hold Own

Gas oils, both the straightrun and the zero quality, have held their own right along with considerable firmness. The straightrun has not held for the past several weeks quite as strongly as has zero material but there is a real feeling of firmness now as the gas companies are certain to increase their consumption of gas oil with colder weather. This kind of temperature is felt all along the line of fuels and as the gas companies in this section are now heating a good many homes and want to heat a great many more, they will use considerable oil in their winter gas supply. The market for straightrun gas oil was slightly below 3 cents Group 3 for good material. Some cheaper gas oil was to be had but much of this was either of a lower gravity or had a rather high sulphur content or was deficient in some of the specifications. One gas company was in the market for a 32-34 gas oil straightrun and its idea of the prices was 2¾ cents maximum. There is something peculiar in the specifications of some gas companies and they remind some of the buyer who when any seller of fuel oil stressed some particular merit in his oil, added the quality to his specifications until he had some that were very contradictory. The zero gas oil is so much in demand for furnace fuel that any other use is hardly considered at present. There is an apparent lack of stocks of the desirable oil and many refiners return the reply to a request for a quotation that they have no zero gas oil on hand or are committed ahead for all they can run. With a larger demand apparently near at hand, if not right here, the refiners are asking full prices and in some instances they have asked an eighth of a cent more than they have sold at previously. With less cracking units at work now that the gasoline demand is decreasing, the output of zero gas oil may be less than the actual consumption and higher prices will be the result. The colder weather has changed the views of many that gas oil would be easier in December than it had been in November.

Fuel Oils

The heavy industrial fuel oils are in good demand. The bulk of the movement is on contracts, in fact there are seemingly more contracts in force today than for years. The spot movement is fairly large. Some monthly buyers seemed a little slow in making their wants known for December but there was considerable buying by these concerns and usually for their regular quantities. Right now the cold weather is causing a demand for fuel oil for heating which is an addition to the consumption in the industries for manufacturing purposes solely.

There is no doubt at this day regarding the advantages of oil for fuel and that this demand can be increased. For a complete success it is essential a supply be maintained and as few changes in the product be made as possible. There are many complaints regarding the quality of the heavy fuel oil furnished, and the reply is often made that other users find the very oil of which the complaint is made to be excellent. The reason for this is often the different type of equipment in different plants. In some instances it is the better understanding of the fuel or the management of the equipment that enables one user to praise an oil which another rejects. Such instances are best avoided if possible for a buyer for a plant will seek for the grade of oil that works best in his plant, not that of some neighbor or some mythical experimental plant.

The immediate demand has been greatly stimulated by the weather and zero fuel oils are the only ones that will do. Orders which have been filled with near-zero oils will no longer be satisfied by that grade of oil and every buyer who stipulates for a zero oil will insist on having it. One buyer who complained of being unable to draw off the contents of a car supposed to be a zero 17-20 fuel oil was told the oil broke up very easily with a little heat. "But there are no coils in the car; am I supposed to build a fire under the car?" was the buyer's reply. Prices in the Chicago market are practically unchanged. Dealers are trying to get better prices but find there are some quantities of oil being sold at the old prices. Refiners' quotations are

(Continued on Page 219)

No Major Price Changes on East Coast

Few Minor Recessions on Cylinder Oils and Fully Refined Paraffin Wax. Gasoline Demand Affected by Extremely Cold Weather

By A. E. Mockler
New York Bureau, The Oil and Gas Journal, Rooms 1919-21, No. 154 Nassau Street

NEW YORK, Dec. 2.—There have been no price changes of major importance in East Coast refined products, the market being devoid of changes aside from a few minor price recessions on cylinder oils and fully refined paraffin wax. Volume of business on gasoline has shown some curtailment, but a moderately active market continues on other products.

Signs of increasing activity in the export market for both gasoline and kerosene are evident, and the trade looks for a farily broad movement both at the Atlantic Coast and at the Gulf over the balance of the year.

Tank Car Gasoline

The local market holds at 8¾ cents for U. S. Motor in tank car lots, f.o.b. refineries, with a routine movement in evidence. Refiners are quoting 9 cents at terminals south of New York along the Coast, but a little irregularity develops now and then, and sales at 8¾ cents at these points are not uncommon. Considerable outside gasoline is coming in at Baltimore from both California and Venezuela, and the price is occasionally cut to move some temporary surplus. One factor was reported to have a fairly large quantity of gasoline on hand that did not come up to the specifications of the fuel it is now handling, and it is probable the disposal of some of this gasoline at concessions is responsible for the periodic reports of price cutting at one or two points at the South Atlantic.

Tank car movement has fallen away somewhat due to extremely cold weather in some sections.

Refiners report that total gallonage is well up to the figures for this time last year, and aggregate consumption for the year will show a material gain over 1928 sales totals, with steadily increasing consumption in sight for 1930.

Current demand is swinging over to premium quality gasolines, and high-test fuels are steadily rising in the percentages of sales totals on the part of the principal interests in the East.

Tank Wagon Gasoline

The market appears to have become fairly well stabilized, in sympathy with the steady tone which has prevailed in the refinery gasoline situation for some weeks. No further price changes had developed in the East since the 1 cent reduction around the middle of the past month in Delaware and Pennsylvania.

Interest continues keen in the advances made by various companies in building up their direct outlets in the New York area. Shell has again come into the spotlight on rumors that Shell Eastern was negotiating to take over the business of Warner-Quinlan.

One or two of the large companies are still utilizing the barrel method of making deliveries to retail stations in New York City, but the trend toward tank wagons is becoming more pronounced, and gasoline barrels will shortly become a thing of the past in the metropolis.

Kerosene

Refiners report a slight gain in the wholesale demand and the tank car market for water white is fairly steady at 7¾ cents, with a good movement in progress. Stocks are not burdensome at East Coast refineries, and a consistently good export inquiry is aiding in keeping the market in strong position.

Changes are lacking in the tank wagon kerosene situation. Business is on the increase, and the market appears pegged at current levels for the remainder of the year at least. The 15-cent price has held in New York territory for more than two years, something highly out of the ordinary in such a competitive market. The same period has marked numerous changes in the refinery price basis.

Lubs

Steam refined stocks have eased off a little, under continued quiet demand. On 600 steam refined oil, supplies are available at 32½ cents, down a half cent, with similar reductions shown on 635 at 34½ cents and 650 at 38½ cents. No change developed on 600 Pennsylvania flash and 630 flash, although available stocks continued limited and trading routine. Limited activity was also to be noted on Warren "E" and Oil City "E," both of which were unchanged in price. The undertone on bright stocks remained rather soft, but no further price changes developed.

Cylinder oils are in rather unsettled position at the moment. Continuance of the recent dull demand, it is felt, will result in a general decline involving all grades. Any appreciable quickening in buying interest, however, would have just the opposite effect, and probably result in a higher market. It has developed into a waiting situation, with neither sellers nor buyers disposed to break the deadlock.

Red and pale oils remained in steady position throughout the week. A fair volume of business was reported in tank car markets, with contract deliveries still accounting for a substantial percentage of the current movement.

Paraffin Wax

Prices have eased off further under quiet trading. Revised quotations for fully refined grades follow: 120-122 a.m.p., 3.80 cents per pound; 125-127 a.m.p. 4.15 to 4.25 cents per pound; 130-132 a.m.p. 4.50 cents per pound; 133-135 a.m.p. 5.75 cents; 135-137 a.m.p. 6.125 cents per pound.

Domestic demand for paraffin has been sluggish, due in some measure to the desire on the part of consuming manufacturers to hold down stocks for inventory purposes at the close of the month. Export volume has fallen below expectations, although it is believed that a fair amount of foreign business is in the market "at a price," and that buying will develop along fairly broad lines in the event that export operators are able to secure any material price concessions on prompt shipment wax. Refiners thus far, however, have shown no inclination to force sales at the expense of prices, notwithstanding the fairly heavy stocks of paraffin wax on hand at their plants.

Fuel Oil

Active demand for fuel oil continues throughout the Eastern area, and the market is in steady position. Bunker "C" continues held at $1.05 per barrel at refinery terminals. Contract withdrawals are heavy, and in addition there has been a fair amount of spot buying in the market.

Jobbing demand for furnace oils has picked up considerably, under the influence of colder weather, and refiners believe demand for this product has now hit its seasonal stride. Stocks of the more wanted grades are by no means excessive here, and with a similar condition prevailing at other refining centers from which the East Coast might draw supplies, the outlook is for an advance in both the wholesale and retail basis for furnace oil. California distillate has been arriving at East Coast ports in larger quantities during recent weeks, and reports from the Pacific Coast indicate a continued heavy movement is in sight for the balance of the winter. This oil is being moved readily into distributing and consuming channels with no adverse effect upon the Eastern market.

Refiners are signing up some industrial business on contract for 1930, with the current quotation generally the basis in such deals, it is reported. Most large maine companies are under contract for all of 1930, which will witness the expiration of the 3-year contracts booked by many interests covering deliveries for 1928, 1929 and 1930. With the crude oil production situation getting more in hand, interest in the possibility of an advance in the price of bunker oil during the coming year has been revived, with some predictions that the end of 1930 will witness a market of $1.15 to $1.25 in the East Coast area. All this, however, naturally falls within the realm of speculation, although possibly influencing some buyers in the placing of contracts for next year at present prices.

Gas Oil

Artificial gas companies have come into the market for gas oil in larger quantities, and a steady to strong undertone rules. Principal refiners continue to quote recycled 32-36 gas oil at 5¼ cents, although, as has been the case for some weeks, it is still possible to buy this oil in a small way an eighth to a quarter cent under that figure.

There is some contracting for 1930 gas oil requirements under way, although thus far at private terms. It is not expected business for the new year will call for a price radically different. Refiners in this territory believe it a matter of time before natural gas will be piped into New York to be used as an enriching mixture for low grade manufactured gas, or perhaps placed right into consumption in the natural state, but the progress of hydrogenation, from current indications, will be such that by the time natural gas becomes a factor here, the disposal of recycled gas oil will no longer be a problem.

Steadily widening consumption of low grade gas oil as a furnace fuel is another factor of no small importance in the East, particularly in the New York and New England territories.

Diesel Oil

Routine activity has characterized the Diesel oil market, with sellers continuing to quote $2 per barrel, in bulk, at refinery terminals, and indications that this price will hold likewise on 1930 contracts.

The bulk of the current business is with the marine companies, which are steadily growing in importance in the Diesel oil market. Domestic consumption is picking up slowly, with the outlook for larger consumption in both fields extremely favorable over the next few years.

Export Markets

Two small inquiries are in the market, their placing being depending upon the securing of cargo space for second-half December shipment. The first is for 2,000 tons of 64-66 and the other for a similar quantity of Navy, both cargoes being destined for France. Another French cargo, involving between 55,000 and 60,000 barrels of 64-66, is also in the market.

One of the large Eastern refining companies booked the 9,000-ton cargo for France which the trade was bidding on last week. The cargo, which was sold at Export Association prices, involved 2,000 tons of prime white kerosene, 2,000 tons of 61-63 naphtha, and 5,000 tons of 64-66 naphtha, all for second half December listing.

There was a little activity in Panuco crude reported, with some business passing at 65 to 66 cents per barrel, at Panuco terminals.

In view of the comparative quiet in export markets for gasoline and kerosene up to the middle of November, export operators are inclined to look for a substantial volume of foregin business during the remainder of the year, both at the Gulf and in East Coast markets.

Sluggishness marks the export paraffin wax market, and values have sagged in sympathy with the lack of buying, both crude scale and refined grades showing some easiness.

British buyers have not been taking cylinder stocks in normal volume during recent weeks, and the same holds true of operators on the Continent. European buyers are believed to be holding off pending further price recessions, and the market position is rather unsettled at the moment. Red and pale oils, however, are moving in fair volume, both here and at the Gulf Coast.

Petroleum Exports

The following table shows principal exports of refined petroleum products from New York for the past three weeks (all figures in gallons unless otherwise noted):

	Week ended		
	Nov. 23	Nov. 16	Nov. 9
Gasoline	156,000	21,000	354,200
Naphtha	580,200	798,600	494,300
Kerosene	158,300	232,000	150,000
Fuel Oil	1,518,500	932,000	10,100
Lubricating oil	1,563,900	1,416,800	705,900
Petroleum, refined	675,800	534,500	4,619,800
	Pounds		
Petrolatum	27,000	32,600	127,200
Paraffin wax	801,400	887,300	1,301,400
Refined	412,000	25,000	12,000
Scale	62,300	945,200	97,000
Lubricating grease	835,200	1,518,200	870,800

Export movement of refined petroleum, under which classification gasoline and kerosene predominate, has fallen off during the past fortnight at East Coast ports, but an early improvement is looked for. The paucity of export movement from the local port is accounted for by most of the big business moving out of Philadelphia and Baltimore in recent weeks. A better movement of lubricating oil out of New York has developed while export volume on the minor products, such as petrolatum, wax, and lubricating grease has continued along routine lines.

Imports

Imports of crude and refined oils at the principal United States ports for the week ended November 23 totaled 1,808,000 bbls. a daily average of 258,285 bbls., compared with 2,190,000 bbls., a daily average of 312,857 bbls. for the week ended November 16 and a daily average of 270,071 bbls. for the four weeks ended November 23. Details follow:

	Bbls. of 42 Gls.
At Atlantic Coast Ports—	
Boston	137,000
New York	1,087,000
Philadelphia	276,000
Others	148,000
Total	1,648,000
Daily average	235,428
At Gulf Coast Ports—	
New Orleans & Baton Rouge	105,000
Port Arthur & Sabine District	55,000
Total	160,000
Daily average	22,857
At all United States Ports—	
Total	1,808,000
Daily average	258,285
Daily average 4 weeks	270,071

California Oil Receipts

Receipts of California crude and refined oils at Atlantic and Gulf Coast ports for the week ended November 23 totaled 548,000 bbls., a daily average of

(Continued on Page 278)

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Natural Gasoline Manufacture

CALIFORNIA OUTPUT AT NEW PEAK IN OCTOBER

California natural gasoline production established a new peak in October with a total of 79,598,646 gallons according to the latest report of the Bureau of Mines. This average production of 2,567,700 gallons daily compares with an average of 2,489,585 gallons in September, the previous peak in the history of the west coast industry.

Practically all of the increase in October could be accounted for by the greater production in the Santa Fe Springs area which totaled 26,198,560 gallons for the month. In September, the production of that area was 23,413,951 gallons.

Utilization of natural gasoline amounted to 1,970,206 bbls., an increase over September of 206,474 bbls. Daily average utilization of 63,555 bbls. was 2,419 bbls. more than daily average production of 61,136 bbls.

Stocks of natural gasoline at the end of October amounted to 1,350,075 bbls., of which 40,980 bbls. were reported by natural gasoline plant operators and 1,309,095 bbls. by refinery operators. This is a decrease of 75,000 bbls. under September stocks. This stock figure of 1,350,075 bbls. is approximately 21 days supply at the current rate of consumption.

CALIFORNIA NATURAL GASOLINE PRODUCTION, DISTRIBUTION AND STOCKS

October, 1929

Production by fields:

	Natural gasoline produced (gals.)
Fullerton and Whittier	1,307,316
Midway	4,857,719
Huntington Beach	3,705,872
Long Beach	20,124,808
Richfield	1,373,765
Santa Fe Springs	26,198,560
Seal Beach	4,276,136
Ventura Avenue	7,064,543
All other fields	10,689,927
Totals	79,598,646

Production:

Type of plant	Natural gasoline produced (gallons)
Oil absorption	54,917,429
Compressor	267,462
Combination Comp. and oil absorption	24,405,589
Drip	8,166
Totals	79,598,646
Finished gasoline produced at plants	24,469 bbl.

Distribution:	Bbls	Bbls.
Stocks first of month		1,425,075
Produced during month		1,895,206
Quantity mixed with crude or unfinished oils	207,239	
Used in blending at refineries	1,484,938	
Stock end of month	1,350,075	
Evaporation losses	19,378	
Balance	258,651	
	3,320,281	3,320,281

Stocks:	Gallons	Bbls.
Natural gasoline held by natural gasoline plant operators	1,721,169	40,980
Natural gasoline held by refineries	54,981,990	1,309,095
Totals	56,703,159	1,350,075

INCREASES LARGE PLANT

The General Petroleum Corp. of Los Angeles has enlarged its plant in the Santa Fe Springs Field of California so that it has a capacity of 185,000 gallons daily. The plant now ranks with the plant of the Shell Co. of California which has previously been considered the largest plant of the natural gasoline industry.

The General corporation is an active operator in the Santa Fe Springs area and the completion of new wells is constantly adding to the quantity of gas available at the plant. The company has also added to the capacity of some of its other plants so that its five plants have a capacity of 327,000 gallons daily. The company's Brea plant in the Tonner Canyon Field is shut down.

Who's Who
IN NATURAL GASOLINE MANUFACTURE

Standard Gasoline Co.*

The Standard Gasoline Co. is the largest manufacturer of natural gasoline in California and is generally rated as the second largest manufacturer in the entire country.

While the company is a 100 per cent owned subsidiary of the Standard Oil Co. of California with the same officers as the parent company, it is to a large extent operated as a distinct unit. The gasoline company was organized in 1926 when the Pacific Gasoline Co.'s properties were taken over. At that time the Standard and Pacific companies gasoline plant operations were combined and the entire operation centered in the Standard Gasoline Co.

The company is now operating 41 plants of various types scattered in all of the principal fields of California. In addition the company has nine plants which are listed as shut down. The company does not give the capacity of its plants in gallons but a recent check showed that the plants were handling 510,745,000 cubic feet of gas daily. The output of finished gasoline from this wet gas was in excess of 500,000 gallons daily. The bulk of the casinghead gas in California, especially that coming from the older fields, has a gasoline content of less than one gallon per thousand cubic feet and this fact accounts for the relatively low production considering the amount of gas run to the plants.

Since the consolidation of the Standard and Pacific properties the efficiency of the plants has been greatly improved. Previously most of the Standard plants were of the compression type and little attention was paid to the specifications of the finished products. Now most of the plants are modern in design of the combination oil absorption and compression type.

Refinery Outlets

Practically all of the plant output is absorbed by the refineries of the Standard Oil Co. of California. The parent company operates two plants with a capacity of 100,000 bbls. daily each at Richmond and El Segunda, Calif., and a third plant of 25,000-bbl. daily capacity at Bakersfield, Calif. Some of the natural gasoline output has been moved to the refineries in the south part of the state by separate pipe lines and in other cases it is blended with the crude oil and transported by pipe line.

The company has been a large seller of residue gas to natural gas companies. Part of the gas is also transported by pipe line to refineries where it is used as fuel. The parent company recently acquired control of a large natural gas company in California.

Earle Derby is manager of the Standard Gasoline Co. with headquarters in the Standard Building at San Francisco. R. E. Beckley, who is general superintendent of the plants, is in charge of the Los Angeles office. Mr. Beckley is well known in the natural gasoline fraternity. He was recently elected president of the California Natural Gasoline Association.

The field department is divided into the southern, northern, and Ventura divisions. Each division has a superintendent, engineer, supervisor, inspector, storekeeper, chief clerk and several foremen with supervisors at each plant. The management makes a special effort to secure the maximum co-operation from employes. A house organ called "The Booster" is published monthly. Employes are given the opportunity to take special courses concerned with their work. D. M. Wolfe is head of the general technical department and F. C. Loomis, engineer, is in charge of design.

The following table gives a list of the operating plants of the Standard Gasoline Co.:

Location	M.C.F. daily capacity gas treated
Santa Fe Springs	5,497
Santa Fe Springs	16,500
Santa Fe Springs	17,400
Montebello	10,176
Murphy-Coyote	10,870
Kraemer	8,919
Brea	2,282
Huntington Beach	6,810
Huntington Beach	5,720
Huntington Beach	23,200
Hunting on Beach	9,666
Huntngton Beach	6,918
Huntington Beach	8,550
Seal Beach	25,000
Seal Beach	7,000
Long Beach	3,000
Long Beach	5,395
Long Beach	24,000
Long Beach	12,000
Dominguez	2,755
Athens	1,670
Inglewood	6,900
Inglewood	21,409
Torrance	9,325
Whittier	627
Cypress	6,000
Ventura	12,000
Ventura	32,000
Ventura	32,000
Taft	10,200
Taft	11,550
Taft	30,000
Taft	3,500
Taft	4,500
Taft	5,500
Taft	5,800
Taft	4,750
Wheeler Ridge	1,000
Newhall	226
11-P	100,000

*Second of a series of articles describing briefly the operations of the major natural gasoline manufacturers in the United States.

A PRACTICAL SUGGESTION

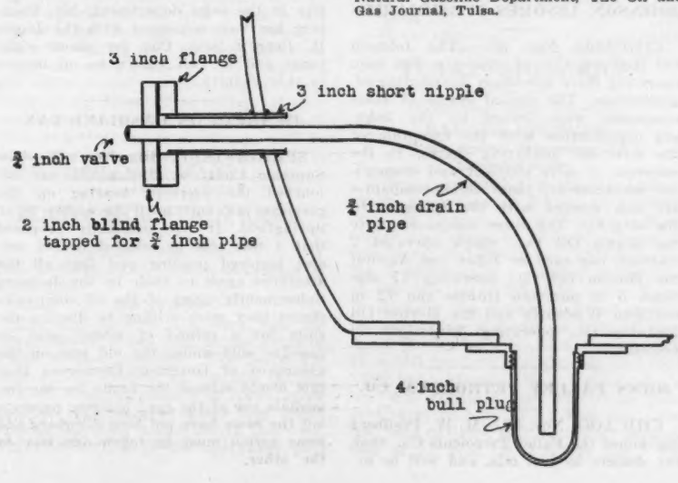
WATER DRAIN DEVICE

The accompanying sketch shows a water drain device used for draining undesirable condensate from pressure storage tanks, etc. The device is particularly suited for gasoline plant storage tanks when in winter weather the usual type drains are frequently broken by the expansive action of the water, thus endangering the contents of the tank.

The only portion of this device exposed to the freezing action is the bull plug and due to its shape and strength it is not affected. The drain valve on the end of the three-fourths-inch drain pipe will drain free of water and always be in a workable condition, although it may be necessary to steam the bottom of the tank to melt the ice in order to remove the water.

The device is constructed so that it can be put on old tanks and removed for inspection if necessary without entering the tank. This requires the length of the 2-inch or 3-inch nipple to be such that the drain pipe with its necessary curvature will pass through it.

Practical suggestions by those connected with the construction and operation of natural gasoline plants are invited. Payment will be made as soon as suggestions are accepted. Address all communications to the Natural Gasoline Department, The Oil and Gas Journal, Tulsa.



LONE STAR ADDS PLANT

The Lone Star Gas Co., by the addition of two plants has increased its natural gasoline capacity so that it now exceeds 100,000 gallons daily. The company recently started operating a 10,000-gallon plant in Eastland County, Texas, and a 2,000-gallon plant in Comanche County, Texas.

The company has also made minor changes in some of the remaining plants which the company has operated for some time. The Gordon plant in Palo Pinto has been increased from 25,000 to 35,000 gallons daily. This is the largest of the 10 plants which have a total capacity of 112,000 gallons daily.

The Lone Star company is a large distributor of natural gas in Texas and most of the gasoline plants are located along natural gas lines. Most of the gas that it processed has a low gasoline content.

HENDERSON PLANT

The new plant which the Henderson Co. of Tulsa recently completed in the Texas Panhandle now has a rated capacity of 12,000 gallons daily. The plant is located 35 miles northwest of Amarillo, Tex., near Sanford. The plant is of the oil absorption type.

Brief Items for Petroleum Refiners

Standard-I. G. Co. Formed to Exploit Hydrogenation Process

NEW YORK, Dec. 2.—Frank A. Howard, manager of the development division of the Standard Oil Co. of New Jersey and president of the Standard Development Co., has been named president of Standard-I. G. Co., a corporation organized jointly by Standard of New Jersey and I. G. Farbenindustrie for American exploitation of Farbenindustrie's hydrogenation process. Mr. Howard is now building a new plant unit at Bayway, where large scale operations utilizing the hydrogenation process will be carried on. Other officers of the new company are E. M. Clark, vice president; H. H. Eames, secretary; R. P. Resor, treasurer. Directors are E. M. Clark, Walter Duisberg, R. T. Hasima, F. A. Howard, Peter Hurll, H. A. Riedemann, H. G. Seidel, C. A. Straw, Otto Von Schrenk and Guy Wellman. Standard of New Jersey is now building three plants, all partly experimental and partly commercial, locater at Bayway, Baton Rouge, La., and Baytown, Tex., which will have large scale output and if possible operate the hydrogenation process on a profitable basis, although they are described as essentially laboratories for carrying on experimental and pioneer work on a large scale. Standard of New Jersey, in its forthcoming issue of The Lamp, will say of the hydrogenation development:

"Production of heavy fuel oil has definitely passed its present economic limits as a petroleum product. Despite the maintenance throughout the past year of low price levels on fuel oil, the market would not absorb the production. Stocks of heavy fuel oil will show a material increase for the year. There is no indication of any coming increase in the heavy fuel outlet sufficient to match the estimated increase in demand for gasoline and other light fuel. No one can foresee the limits to which these latter markets may grow along their present lines of expansion. It seems now, however, that increase in heavy fuel consumption will be obtainable only by forcing the product into less and less favorable markets. A change in the prevailing character of the world's crude oil supplies might readily restore a balance, but there are no prospects of obtaining any immediate help from this source, nor is it a happy situation for the industry to rely upon chance to maintain its equilibrium.

"The hydrogenation process provides a definite, although not an easy, solution of this basic problem of the industry. At its inception the process was regarded primarily as one for converting coal into oil. But the experiments in which the technique of this problem was mastered were not confined to coal alone—the hydrogenation conversion process was shown to be applicable to the conversion of heavy asphaltic products of the class of heavy fuels into gasoline and distillates of the class of light fuels. There was thus provided a scientifically possible solution of the two foremost problems of the industry. First, that of quantity of supply and demand, and, second, that of maintaining a balance between supply and demand of light and heavy products. A third problem, secondary but of great commercial importance, was also shown to be capable of at least partial solution. That was the problem of altering the chemical structure of the constituents of the oil. Science thus opened to the petroleum industry in the form of the hydrogenation process an indefinitely greater enlargement of its range of operation as a conversion industry.

GASOLINE STOCKS NOT EXCESSIVE IF MEASURED IN TERMS OF DEMAND

Although the latest available report of the Bureau of Mines showed gasoline stocks on October 1 to be 25.9 per cent in excess of the same date last year, the stocks based on days' supply were not much greater. The government reports show that on the first of October, gasoline stocks at refineries totaled 33,222,000 bbls., an increase of 6,844,000 bbls. over the same date in 1928.

However, due to the large increase in consumption of gasoline over the past year, refinery storage on October 1 represented only 26 days supply compared with 23 days a year ago when total gasoline stocks were exceptionally low.

Gasoline consumption for the first nine months of this year had shown a 14.5 per cent increase in the domestic market and 11.6 per cent in the export market. This increase is exceptionally large and for that reason statisticians who consider all stocks from the standpoint of days' supply rather than volume do not believe that the stocks on October 1 were excessive.

As shown in the accompanying chart since early in 1924 there has been a distinct trend toward lower gasoline stocks based on days' supply. There was a large drop in 1928 and so far this year the stocks have been approximately the same measured in days' supply. The desire to prevent the accumulation of heavy gasoline stocks in winter months which tend to weaken the summer market is responsible for this situation. The fact that practically all refiners now have cracking facilities with which they are able to obtain large yields of gasoline is also responsible in part for this trend as refiners no longer find it necessary to run considerable gasoline to storage in order to take care of the demand during the season of maximum consumption.

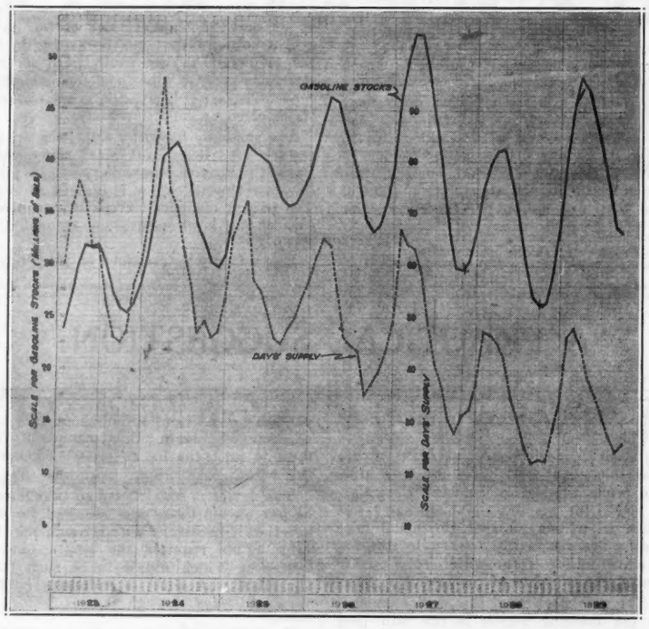


Chart showing gasoline stocks (upper line) and days' supply (lower line).

JOHNSON ABSORBS SUBSIDIARIES

CHICAGO, Nov. 30.—The Johnson Oil Refining Co., of this city, has been operating three subsidiary distributing organizations. The capital stocks of these companies were owned by the Johnson organization with the exception of the directors' qualifying shares. In the interests of more efficient and economical management, these three companies are now merged with the Johnson Oil Refining Co. The three companies were the Kirgis Oil Co., which operated 2 stations, one each at Joliet and Aurora, the Horton Oil Co., operating 17 stations, 5 in northern Illinois and 12 in southern Wisconsin and the Horton Oil Refining Co., operating 3 stations in Indiana.

JOINS FALLEY PETROLEUM CO.

CHICAGO, Nov. 30.—M. W. Prellberg has joined the Falley Petroleum Co., tank car dealers in fuel oils, and will be active in the sales department. Mr. Prellberg has been connected with the James B. Berry's Sons Co., for about eight years and is well known to oil buyers in this vicinity.

HEARING ON GASOLINE TAX

SPRINGFIELD, Ill., Nov. 30.—The Supreme Court at Springfield has adjourned the proposed hearing on the gasoline tax suit until December 9 at Springfield. It was originally proposed that a test case be selected out of several hundred pending and that all the attorneys agree to abide by the decision. Subsequently many of the oil companies stated they were willing to dismiss the suits for a refund of money paid on gasoline sold under the old law on the assurance of Governor Emmerson that this would release the funds for the immediate use of the road building program but the cases have not been dismissed and some action must be taken one way or the other.

H. L. HUGHES RESIGNS AS SALES MANAGER

H. L. Hughes, resigned as sales manager for the Barnsdall Refineries, Inc., effective December 1, and expects to wait until after the first of next year before entering into active business. Mr. Hughes has been with the Barnsdall companies since the purchase of the Big Heart Producing & Refining Co. by Barnsdall in December, 1920. Prior to that he was in the sales department of the purchased company, having entered its employ February 19, 1919.

In the 10 years that Mr. Hughes has been active in the sales work of these companies he has gained a wide acquaintance. He has chosen not to definitely state his plans for the future.

No successor to Mr. Hughes has been named by the company and this may extend into some time in the future with the general sales direction being handled through George Locke, vice president in charge of sales at the company's Chicago offices.

ENLARGE DEL RIO PLANT

FORT WORTH, Tex., Nov. 29.—The Del Rio Refining Co. is now installing equipment in its Del Rio, Texas, plant, which will enable it to run 5,000 bbls. of crude oil per day, an increase of 1,500 bbls. daily over the present runs. This extra equipment is being added in order to allow the company to take care of a large order of fuel oil which recently has been contracted for.

The company is also reopening sales office in Chicago, with P. H. Hertzog, sales manager in charge.

The Del Rio plant is the only refinery between El Paso and San Antonio, Tex., and obtains crude oil from the Illinois Pipe Line Co., which has a large tank farm just east of Del Rio on its 8 and 10-inch line from the Yates Pool in Pecos County to the Humble Oil & Refining Co.'s main station at Lytle in Atascosa where the crude from the Illinois line is run into the Humble's main line to Corpus Christi.

The Del Rio refinery supplies a large quantity of fuel oil to the Southern Pacific railroad which runs through Del Rio from San Antonio on west to the Pacific coast.

J. P. GILLAM RESIGNS

HOUSTON, Tex., Nov. 30.—J. P. Gillam, for several years superintendent of the Deepwater Oil Refineries, Inc., plant here and the past year vice president and manager of refining for the company, has resigned, and Roger Q. Traweek, assistant to Mr. Gillam has been chosen to succeed him as manager of refining. Mr. Traweek, previously with Deepwater was superintendent of the Crown Central Petroleum Co. plant at Pasadena, east of Houston.

TO MEET IN SHREVEPORT

At a meeting of the board of directors of the Western Petroleum Refiners Association held in Chicago this week it was decided to hold the next annual meeting of the association in Shreveport, La. The meeting will be held on March 11.

JOHNSON APPOINTS MANAGER

Henry G. Plane has been appointed sales manager for the refinery division of the Johnson Oil Refining Co. Mr. Plane succeeds George H. Williams, who resigned to accept the position as division manager at Chicago for the Transcontinental Oil Co.

KANSAS FIELDS

(Continued from Page 68)

Piatt, NE cor. NW NW, Section 31-23-6. Empire Oil & Refining Co. made location for No. 13 Cranston, NE cor. SE, Section 22-27-5. Garden and others built the rig for No. 5 Sluss "B," NE cor. NW NW, Section 6-27-6. Phillips Petroleum Co. has the rig up for No. 5 Tatum, SE cor. NE NW, Section 9-27-6. Pyle & Sutter made location for No. 1 Smith, SE cor. NW SE, Section 34-28-6. Aladdin Petroleum Co.'s No. 1 Ow, NE cor. SE, Section 20-26-7, has been completed for 18 bbls. in sand 2,734-42 feet. The Prairie Oil & Gas Co.'s No. 1 A. M Seymour, NE cor. NW, Section 6-27-8, is dry and abandoned at 3,167 feet.

Chase County

Polhamus and others' rig is up for No. 3 Leidy, SW cor. SE, Section 25-22-9.

Coffey County

Hines and others' No. 1 Barngrower, NW cor. SW NW, Section 7-23-15, made 10 bbls. in sand 1,587-94 feet.

Cowley County

Fine and others made location for No. 1 Brown, SE cor., Section 8-32-4. The Prairie Oil & Gas Co.'s No. 1 Graham, NW cor. SW, Section 23-32-4, is a dry hole at 3,505 feet.

Elk County

Minnehoma Oil Co. & Murphy's No. 2 Denton, NW cor. SW SW, Section 3-31-8, has been completed for 200 bbls. in sand 1,983-2,000 feet. Mann and others' No. 1 Dorey, SW cor., Section 6-31-9, is dry and abandoned at 2,395 feet.

Ellis County

Mid-West Exploration Co. has dug the cellar for No. 24 Austin, SE cor. NE NE, Section 36-12-16w.

Greenwood County

Phillips Petroleum Co. made location for No. 1 Patterson, SW cor. SE SW, Section 22-23-11. Independent Oil & Gas Co. has the rig up for No. 1 Lozier, SW cor. NW SE, Section 36-24-10. Empire Oil & Refining Co.'s No. 2 Norton "C," NW cor. SE NE, Section 22-22-12, has been completed for 20 bbls. in sand 1,708-15 feet. Dixie Oil Co. & Amerada Petroleum Corp.'s No. 3 Ellis, NE cor. NW NW, Section 27-23-11, made 50 bbls. in sand 1,920-48 feet.

Harper County

T. B. Slick, Jarrett and others' No. 1 Thompson, NW cor., Section 19-32-6w, has been abandoned at 5,125 feet. T. B. Slick and others' No. 1 Miller, SE cor., Section 13-34-8w, has been abandoned at 5,312 feet.

McPherson County

The Prairie Oil & Gas Co. made location for No. 1 Stuckey, NW cor. SW, Section 10-21-3w.

Rice County

Tatlock and others made location for No. 1 Ralston, SW cor., Section 25-19-8w. Vickers Petroleum Co. staked location for No. 1 Binger, NW cor. SE, Section 21-20-10w.

Reno County

W. C. McBride and others staked location for No. 1 Bacon, SW cor. NE SW, Section 36-23-5w. Tatlock & Shell Petroleum Corp. and others made location for No. 1 Tonn, C NW NW, Section 17-25-4w. Milmac Oil Co.'s No. 1 Stuckey, SW cor. NW, Section 17-26-5w, is dry and abandoned at 4,026 feet.

Russell County

Mid-West Exploration Co. made location for No. 6 Gorham, NW cor., Section 9-14-15w. Pryor & Lockhart and others' No. 1 Sellens, NW cor. SE, Section 36-15-13w, made 185 bbls. in sand 3,344-47 feet. The Prairie Oil & Gas Co.'s No. 1 Mary Sellens, NE cor. SW, Section 36-15-13, made 400 bbls. from sand 3,352-63 feet.

Sedgwick County

Bu-Vi-Bar Petroleum Corp. and others' No. 9 Carr, NE cor. SW NW SE, Section 1-26-1w, is a rig under construction. Barnsdall Oil Co.'s No. 1 Samuells, NE cor. NW, Section 24-25-1, has been abandoned at 3,720 feet. Bu-Vi-Bar Petroleum Corp. and others' No. 5 Reed, SE cor. SW SE, Section 1-26-1w, made 592 bbls. from Simpson sand 3,355-59 feet. Bu-Vi-Bar Petroleum Corp.'s No. 2 Hudson "A," NE cor. NW NE, Section 12-26-1w, has been completed for 549 bbls. in Simpson sand 3,363-67 feet. Graham Brothers & Shell Petroleum Corp.'s No. 1 Bogue, SE cor. SW SW, Section 15-26-2, has been completed for 136 bbls. in chat 2,938-39 feet. The Texas Company's No. 1 H. Robbins, SE cor. NW SW SW, Section 21-28-1, is dry and abandoned at 3,542 feet.

Sumner County

Continental Oil Co.'s No. 2 Padgett SW cor., Section 23-34-2, made 50 bbls at 3,516 feet after plugging back from 3,522 feet.

FURNACE AND FUEL OILS ARE FEATURE IN CHICAGO

(Continued from Page 214)

frequently higher than the prices which buyers state they are asked to pay for the same grade of oil. The better demand which should follow this colder spell will probably see more even prices for it should take off the market some lots which, bought earlier in the season, need to be moved very shortly. Refiners in the field are almost a unit in declaring they have little or no fuel oil to sell at present either for immediate shipment or for delivery over December.

Lubs

The market for lubricating stocks is firmly held by refiners especially for bright stocks. Contracts are being closed on the basis of 33 cents minimum and 39 cents maximum Group 3 during 1930, the market date of shipment. There have been some offerings of Mid-Continent bright stocks by second hands who have contracted for more oil than they will use during 1929 and are willing to sell at 2 or 3 cents below the present market. Even at that reduced price they would be a good profit to the seller if he contracted for his bright stocks before June of last year. There is little change in any feature of the market. Some of the lubricating oil experts are disposed to question the worth to the motorist of the motor oils with a fire of over 480 degrees as they claim that with such a high fire, if any of the oil passed above the piston into the combustion chamber it might form a worse carbon deposit than the lower fire oils and if the latter did not last as long they would be more profitable to use in the long run.

Marginal Contracts

There is some disposition among the larger jobbers to go back to the old method of basing their marginal contracts on the tank wagon price rather than on the market. Several are looking for some reliable source of supply, willing to make such a contract, at least salesmen so state. The jobbers complain that the method of determining the market prices adopted does not give them a fair price. They also complain of the very frequent changes in the prices at which their shipments are billed.

There is little talk regarding a general tank wagon price change in this territory. The jobbers seem to be little interested in the price situation but still regard the decline as inevitable and coming soon. The refinery market has already anticipated any tank wagon reduction of a not unusual amount. There is less price cutting than on many occasions when the spread was as large between the refinery and the tank wagon price. None of the large cities outside of Chicago have had their quotas reduced and it is expected the local change will be done away with shortly although there is nothing definite to be stated.

ROCKY MOUNTAIN AREA

(Continued from Page 77)

tion 16-8s-5e, Utah County, is drilling at 1,325 feet.

MONTANA

The high light of the week was the completion of a new well in the Pondera Field, Pondera County. The Teton Petroleum Co., drilling on the NE Section 17-27-4, found a producer in No. 1 Jones good for 250 bbls. at 2,010 feet which extends the field somewhat to the west. The new well is in the northwest part of the field and about a mile from the main producing area.

Sunburst Field reported no new completions. Ohio Oil Co.'s No. 18 Baker should drill into the sand within the next 20 feet.

In the new Buckley Field across the Canadian boundary west of Sweetgrass, the Cosmos Petroleum Co. started spudding about a mile south of the discovery well in Canada. The Monalta Oil Co.'s No. 1 Buckley is underreaming and No. 1 Farbo of the McDonald Syndicate is drilling.

The Cosmos Petroleum Co. will start spudding in a few days on its wildcat on the Milk River anticline north of Browning on Section 22-36-12. The Johnson Syndicate will start drilling at once on Section 17-34-1 on the edge of Sunburst Field.

The second well on the Headlight Butte Dome is drilling below 500 feet, Section 13-35-6. This wildcat is north of Cut Bank where the first well had showings. It is being put down by the Kootenai Oil Co.

Near Joplin, the deep test on the Johnson lease is drilling after a shutdown on account of weather. It is now at 3,460 feet, on Section 1-32-7, and it is being drilled by the Square Deal Petroleum Co.

Rocky Mountain Fields

Daily average production for week ending November 30:

WYOMING	
Salt Creek	33,020
Frannie	720
Big Muddy	2,090
Oregon Basin	4,560
Byron	....
Dutton	30
Elk Basin	660
Ferris	40
Grass Creek	2,160
Greybull	10
Hamilton	880
LaBarge	2,050
Lance Creek	160
Lost Soldier	3,130
Osage	610
Poison Spider	820
Rock River	2,250
Rex Lake	110
Lander	440
Simpson Ridge	60
Teapot Dome	40
Mule Creek	300
Pilot Butte	....
Notches	....
Total	54,340
MONTANA	
Cat Creek	1,270
Kevin-Sunburst	6,890
Pondera	2,420
Lake Basin	70
Total	10,560
COLORADO	
Moffat	1,210
Fort Collins	1,882
Florence	884
Iles	1,128
Tow Creek	435
Boulder	25
Rangely	100
Total	5,664
NEW MEXICO	
Artesia	842
Cap Rock (Maljamar)	415
Hogback	400
Rattlesnake	1,633
Table Mesa	112
Jal	80
Hobbs High	320
Total	3,802
Grand total	74,366

TEXAS PANHANDLE

(Continued from Page 86)

RANGER DISTRICT
Week ending November 30
Brown County

Bridér trustee's No. 6 Munselle had an initial production of 2 bbls. at 1,180-88 feet. E. Curry's No. 3 Prather had an initial production of 25 bbls. oil and 2 bbls. water at 1,313-21 feet. Phil French's No. 4 Belvin had an initial production of 169 bbls. at 1,294-1,318 feet. Anna B. Gordon's No. 1 Cannon-A had an initial production of 2 bbls. at 1,293-97 feet. Anna B. Gordon's No. 4-A Cannon had an initial production of 60 bbls. at 1,188-1,200 feet. Humble Oil & Refining Co.'s No. 4-B Hickman had an initial production of 75 bbls. at 1,278-90 feet. Its No. 10-A Kilgore had an initial production of 35 bbls. at 1,123-48 feet. Its No. 17-B Kilgore had an initial production of 30 bbls. after having been shot with 20 quarts at 1,157-65 feet. E. L. Smith's No. 21 George had an initial production of 150 bbls. at 1,322-44 feet. A. D. Bruce's No. 1 Boysen was dry and abandoned at 1,240 feet. Cranfill & Reynolds' No. 2 McDonald was dry and abandoned at 840 feet. Humble Oil & Refining Co.'s No. 2 Martin had an initial production of 20 bbls. oil and 4 bbls. water at 967-73 feet.

Coleman County

Diana Oil Co.'s No. 1 Morris had an initial production of 200 bbls. oil at 202-40 feet. The location was abandoned on the Prairie Oil & Gas Co.'s No. 1 Crowder. Joines and others' No. 2 Stewardson was dry and abandoned at 1,556 feet. Lloyd Oil Corp.'s No. 1 Bartholemew had an initial production of 150 bbls. and 2,000,000 feet of gas at 1,443-44 feet.

Eastland County

Alworth trustee and others' No. 2 Harbin had an initial production of 2 bbls. at 1,508-26 feet. Hopkins' No. 2 Davis was dry and abandoned at 3,703 feet. Ed Kouch's No. 1 Jones was shot with 70 quarts at 3,439-71 feet and had an initial production of 148 bbls. oil and 3,000,000 feet of gas. Lone Star Gas Co.'s No. 1 August had an initial production of 3,116,000 feet of gas at 3,375-3,445 feet. Meyers and others' No. 1 Byrd was dry and abandoned at 1,365 feet. Whiteside Brothers' No. 2 Murrell had an initial production of 12 bbls. oil 8 per cent water at 1,322-32 feet.

Stephens County

Byers Oil & Gas Co.'s No. 1 Hatten was dry and abandoned at 2,111 feet. J. B. Dale's No. 4 Litton was dry and abandoned at 1,747 feet. The Texas Company's No. 4-B Parks was shot with 180 quarts at 3,207-90 feet and had an initial production of 200 bbls.

Shackelford County

Carter Development Co.'s No. 1-66 Nail was dry and abandoned at 1,315 feet. Hart & Gist's No. 2 Clark was dry and abandoned at 890 feet. Manning's No. 1 Newell was dry and abandoned at 1,290 feet. Moutray Oil Co.'s No. 3 Nail was dry and abandoned at 841 feet. Sedgwick & Owens' No. 2 Morris & Buie was dry and abandoned at 1,697 feet. Union Oil Co. of Nevada's No. 1 Davis was dry and abandoned at 1,507 feet.

TIDE WATER BONUS

NEW YORK, Dec. 3.—Tide Water Oil Co. thus far in 1929 has awarded to employes of its Bayonne refinery a total of $983 for suggestions for improvement in refinery operations, a total of 243 suggestions having been acted upon during this period. This is an increase of 61 per cent in number of suggestions and over 100 per cent in amount of awards over the 151 suggestions acted up and total of $486 awarded during the first 11 months of 1928.

In a notice to employes, the company says: "An idea is not much use unless it is put into practice. In order to be of any value, it should be put to work. If it is kept buried in the brain of the one conceiving it, it will benefit no one. The idea that is put to work benefits both the man with the idea and the company that uses it.

"All employes are urged to send in suggestions which they think will lead to improvement of equipment, methods, or products. They are particularly desired on the following subjects:

"1. Improvements in manufacturing methods.
"2. Improvements in products.
"3. Reduction of costs.
"4. Elimination of waste.
"5. Elimination of fire and accident hazards."

David D. Beach of the cost department of the Bayonne refinery, is secretary of the suggestions committee. In addition to the cash awards, at the end of the year additional awards are given for the best suggestion during the year and the greatest number sent in by the individual employes and adopted.

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement unless otherwise noted.

GASOLINE AND NAPHTHA

OKLAHOMA (Group 3)—	Dec. 3		Nov. 26		Nov. 19	
50-52 450 endpoint	.06¾	.07	.06¾	.07¼	.07	.07¼
56-58 450 endpoint	.06⅞	.06¾	.06¾	.07¼	.06¾	.07¼
*58-60 437 endpoint (U. S. Motor)	.0722		.0724		.075	
*60-62 437 endpoint	.0725		.0750		.0763	
*60-62 400 endpoint	.0753		.0750		†.07½	.07¾
*64-66 375 endpoint	.08		.0813		†.07¾	.08
68-70 360 endpoint	.08⅛	.08¼	.08	.08¼	.08	.08¼
64-66 437 endpoint (blend)	.07	.07¼	.07¼	.07½	.07¼	.07½

*Weighted average prices December 2, November 25 and 18 as reported by representative refiners. Sales to jobbers only. †No sales reported.

NORTH TEXAS—						
56-58 450 endpoint	.06⅝	.07	.06¾	.07	.06¾	.07
58-60 460 endpoint	.06⅝	.07	.06¾	.07	.06¾	.07
58-60 437 endpoint (U. S. Motor)	.06¾	.07	.06¾	.07	.06⅞	.07
60-62 400 endpoint	.07¼	.07⅜	.07¼	.07⅜	.07¼	.07⅜
64-66 390 endpoint	.07⅝	.07¾	.07⅝	.07¾	.07¼	.07¾
64-66 375 endpoint	.07¾	.08	.07⅞	.08	.07⅞	.08
68-70 360 endpoint	.08	.08¼	.08	.08¼	.08	.08¼
64-66 437 endpoint (blend)	.07⅛	.07¼	.07⅜	.07½	.07¼	.07½
*NORTH LOUISIANA—						
58-60 437 endpoint (U. S. Motor)	.07¼	.07½	.07⅝		.07⅝	
*ARKANSAS—						
58-60 437 endpoint (U. S. Motor)	.07¼		.07½		.07⅝	
PENNSYLVANIA—						
52-54 Naphtha	.07¼	.07½	.07¼	.07½	.07¾	.08
54-56 Naphtha	.07¼	.07½	.07¼	.07½	.07¾	.08
58-60 Gasoline	.08	.08¼	.08	.08¼	.08	.08¼
60 Gasoline	.08	.08½	.08	.08½	.08	.08½
62 Gasoline	.08½	.08¾	.08½	.08¾	.08¾	.09
64 Gasoline	.09	.09¼	.09	.09¼	.09¼	.09½
68-70 350 endpoint gasoline	.10¼	.10½	.10¼	.10½	.10¼	.10½
CALIFORNIA—						
58-60 437 endpoint (U. S. Motor) domestic	.09	.10	.09	.10	.09	.10
CHICAGO DISTRICT (Based on Group 3)—						
50-52 450 endpoint (Naphtha)	.06¾	.07	.06¾	.07	.07	.07¼
56-58 450 endpoint	.06⅝	.06⅞	.06¾	.07	.06¾	.07¼
58-60 437 endpoint (U. S. Motor)	.06⅝	.07¼	.06⅝	.07¼	.06¾	.07½
60-62 400 endpoint	.07¼	.07½	.07⅜	.07⅝	.07⅜	.07⅝
64-66 375 endpoint	.07⅝	.07¾	.07⅝	.08⅛	.07⅞	.08⅛
68-70 360 endpoint	.08	.08¼	.08	.08¼	.08	.08¼
64-66 437 endpoint (blend)	.07¼		.07¼		.07¼	
GULF COAST (Export)—						
58-60 (U. S. Motor)	.08½		.08½		.08½	
60-62 400 endpoint	.09½		.09½		.09½	
61-63 390 endpoint	.09¾		.09¾		.09¾	
64-66 375 endpoint	.10		.10		.10	

*Louisiana, Arkansas, Mississippi and East Texas delivery.

NATURAL GASOLINE

OKLAHOMA (Group 3)—	Dec. 3		Nov. 26		Nov. 19	
Grade A, 72-79.9, 375 e.p., rec. 90%	.06⅞	.07	.06¾	.06⅞	.06¾	.06⅞
Grade AA, 80-87.9, 375 e.p., rec. 90%	.06¾		.06¾		.06¾	
Grade B, 76-83.9, 375 e.p., rec. 85%	.06¼		.06¼		.06¼	.06⅜
Grade BB, 84-92, 375 e.p., rec. 85%	.06¼		.06¼		.06¼	.06⅜
Grade C, 80-90, 375 e.p., rec. 78%	.06⅛		.06⅛		.06⅛	.06¼
NORTH TEXAS—						
Grade A, 72-79.9, 375 e.p., rec. 90%	.06⅞	.07	.06¾	.06⅞	.06¾	.06⅞
Grade AA, 80-87.9, 375 e.p., rec. 90%	.06¾		.06¾		.06¾	
Grade B, 76-83.9, 375 e.p., rec. 85%	.06¼		.06¼		.06¼	.06⅜
Grade BB, 84-92, 375 e.p., rec. 85%	.06¼		.06¼		.06¼	
Grade C, 80-90, 375 e.p., rec. 78%	.06⅛		.06⅛		.06⅛	.06¼
NORTH LOUISIANA—						
Grade AA, 80-87, 375 e.p., rec. 90%	.07¼		.07¼		.07¼	
Grade BB, 84-92, 375 e.p., rec. 85%	.07		.07		.07	
Grade C, 80-90, 375 e.p., rec. 78%	.06¾		.06¾		.07	
CALIFORNIA—						
75-78 375-390 endpoint	.07¾	.08¼	.07¾	.08¼	.07¾	.08¼
CHICAGO DISTRICT (Based on Group 3)—						
Grade A, 72-79.9, 375 e.p., rec. 90%	.06¾	.07	.06¾	.06⅞	.06¾	
Grade AA, 80-87.9, 375 e.p., rec. 90%	.06¾		.06¾		.06¾	
Grade B, 76-83.9, 375 e.p., rec. 85%	.06¼		.06¼		.06¼	
Grade BB, 84-92, 375 e.p., rec. 85%	.06¼		.06¼		.06¼	
Grade C, 80-90, 375 e.p., rec. 78%	.06⅛		.06⅛	.06¼	.06¼	

BURNING OIL

OKLAHOMA (Group 3)—	Dec. 3		Nov. 26		Nov. 19	
41-43 water white kerosene	.04¼	.04¾	.04⅜	.04¾	.04½	.05
42-44 water white kerosene	.04½	.05	.04⅝	.05¼	.05	.05¼
NORTH TEXAS—						
41-43 water white kerosene	.04⅛	.04¼	.04¼	.04⅜	.04¼	.04½
40-42 water white kerosene	.04	.04¼	.04	.04¼	.04	.04½
*NORTH LOUISIANA—						
41-43 water white kerosene	.05		.05½		.05½	
*ARKANSAS—						
41-43 water white kerosene	.05		.05½		.05½	
PENNSYLVANIA—						
43 Kerosene prime white	.06¼	.06⅜	.06¾	.07	.06¾	.07
45 Kerosene water white	.06¼	.06½	.06¾	.07	.06¾	.07
46 Kerosene water white	.06⅝	.06⅞	.06¾	.07	.06¾	.07
47 Kerosene water white	.06¾	.07	.07	.07¼	.07	.07¼
300 Mineral Seal	.07	.07¼	.07	.07¼	.07	.07¼
CALIFORNIA—						
38-40 water white Kero. (high burning test)	.05	.05½	.05	.05½	.05	.05½
Engine distillate, 43-44, 445 endpoint	.07	.07½	.07	.07½	.07	.07½
Engine distillate, 42-44 480 endpoint	.06¾	.07¼	.06¾	.07¼	.06¾	.07¼
CHICAGO DISTRICT (Based on Group 3)—						
41-43 water white kerosene	.04¼	.04½	.04¼	.04½	.04½	.05
42-44 water white kerosene	.04¾	.05	.04¾	.05	.05	.05¼
GULF COAST (Export)—						
41-43 prime white	.07		.07		.07	
41-43 water white	.08		.08		.08	

*Louisiana, Arkansas, Mississippi and East Texas delivery.

FUEL OIL

OKLAHOMA (Group 3)—	Dec. 3		Nov. 26		Nov. 19	
Below 18 Fuel Oil, per bbl.	.65	.70	.65	.67½	.65	.67½
18-22 Fuel Oil, per bbl.	.67½	.72½	.67½	.72½	.67½	.72½
20-22 Fuel Oil, per bbl.	.70	.75	.70	.75	.70	.75
22-26 Fuel Oil, per bbl.	.75	.85	.75	.80	.75	.80
24-26 Fuel Oil, per bbl.	.85	.95	.80	.90	.80	.90
26-30 Fuel Oil, per bbl.	.90	1.00	.90	1.00	.90	1.00
28-30 Fuel Oil, per bbl. (industrial)	1.15	1.20	1.15	1.20	1.15	1.20
32-36 Gas Oil (industrial)	.02¾	.02⅞	.02¾	.03	.02¾	.03
32-36 Gas Oil (straw color)	.03	.03⅛	.03	.03⅛	.03	.03⅛
36-38 Distillate	.03⅝	.03⅞	.03⅝	.03⅞	.03⅝	.03⅞
38-40 Straw Distillate	.03⅞	.04	.03¾	.04¼	.03¾	.04¼
NORTH TEXAS—						
Below 20 Fuel Oil, per bbl.	.60	.65	.60	.65	.60	.65
24-26 Fuel Oil, per bbl.	.85	.90	.75	.80	.75	.80
32-36 Gas Oil (straw)	.02¾	.03	.02¾	.03	.02¾	.03
38-40 Straw Distillate	.03¾	.04	.03¾	.04	.03¾	.04
*NORTH LOUISIANA—						
18-20 Fuel Oil, per bbl.	.80	.90	.80	.90	.80	.90
30-32 Gas Oil	.03¼	.03½	.03½	.03¾	.03½	.03¾
*ARKANSAS—						
33-36 Distillate	.03⅝	.04	.03⅝	.04	.03⅝	.04
30-32 Gas Oil	.03¼	.03½	.03¼	.03¾	.03¼	.03¾
16-22 Refinery Fuel Oil, per bbl.	.80	.90	.80	.90	.80	.90
GULF COAST (South Texas)—						
Gas Oil	.04	.04¼	.04	.04¼	.04	.04¼
Bunker C Fuel (cargo lots), per bbl.	.75		.75		.75	
Bunker C Fuel (small lots)	1.00	1.05	1.00	1.05	1.00	1.05
PENNSYLVANIA—						
30-34 Fuel Oil	.04⅝	.04⅞	.04½	.04¾	.04½	.04¾
36-40 Fuel Oil	.04¾	.05	.04⅝	.04⅞	.04¾	.05
CALIFORNIA—						
33-36 Distillate	.03½	.04	.03½	.04	.03½	.04
26-32 Distillate	.02	.02½	.02	.02½	.02	.02½
15-20 Fuel Oil, Bunker (at tide water)	.65	.85	.65	.85	.65	.85
15-20 Fuel Oil (cargo lots), per bbl.	.70	.85	.70	.85	.70	.85
27 plus Diesel, per bbl.	.90	1.05	.90	1.05	.90	1.05
CHICAGO DISTRICT (Based on Group 3)—						
22-26 Fuel Oil, per bbl.	.77½	.82½	.77½	.82½	.75	.80
18-22 Fuel Oil, per bbl.	.67½	.72½	.67½	.72½	.67½	.72½
28-30 Fuel Oil, per bbl.	1.15	1.20	1.15	1.20	1.15	1.20
32-36 Gas Oil (zero)	.03⅛	.03⅜	.03⅛	.03¼	.03⅛	.03¼
32-36 Gas Oil (industrial)	.03	.03⅛	.02⅞	.03	.02¾	.03
36-38 Distillate	.03⅝	.03¾	.03½	.03⅝	.03½	.03¾
38-40 Straw Distillate	.03¾	.04	.03⅞	.03⅞	.03¾	.04

*Louisiana, Arkansas, Mississippi and East Texas delivery.

LUBRICATING OIL AND WAX

OKLAHOMA (Group 3)—	Dec. 3		Nov. 26		Nov. 19	
100 vis., 2 color, 20-25 cold test	.06¾	.07	.06¾	.07	.06¾	.07
100 vis., 3 color, 20-25 cold test	.05¾	.06	.05¾	.06	.05¾	.06
150 vis., 3 color, 20-25 cold test	.08¼	.08½	.07¾	.08	.07¾	.08
150 vis., 4 color, 20-25 cold test	.07¾	.08	.07½	.07¾	.07½	.07¾
180 vis., 3 color, 23-28 cold test	.09¾	.10	.09¼	.09½	.09¼	.09½
180 vis., 4 color, 23-28 cold test	.09¼	.09½	.08¾	.09	.08¾	.09
180 vis., 5 color, 23-28 cold test	.09	.09¼	.08½	.08¾	.08½	.08¾
200 vis., 3 color, 23-28 cold test	.10¾	.11	.09¾	.10	.09¾	.10
200 vis., 4 color, 23-28 cold test	.10¼	.10½	.09¼	.09½	.09¼	.09½
200 vis., 5 color, 23-28 cold test	.09¾	.10	.08¾	.09	.08¾	.09
240 vis., 3 color, 25-30 cold test	.14¼	.14½	.13¼	.13½	.13¼	.13½
240 vis., 4 color, 25-30 cold test	.13¼	.13½	.12¼	.12½	.12¼	.12½
240 vis., 5 color, 25-30 cold test	.12¾	.13	.11¾	.12	.11¾	.12
280 vis., 3 color, 25-30 cold test	.16¾	.17	.15¾	.16	.15¾	.16
280 vis., 4 color, 25-30 cold test	.15¾	.16	.14¾	.15	.14¾	.15
280 vis., 5 color, 25-30 cold test	.14¾	.15	.13¾	.14	.13¾	.14
Cylinder Stocks:						
600, steam refined, light green	.10	.12	.10	.12	.10	.12
600, steam refined, dark green	.09	.11	.09	.11	.09	.11
190-200 vis., D color Bright Stock	.41	.42	.41	.42	.41	.42
150-160 vis., D color Bright Stock	.37		.37		.37	
150-160 vis., E color Bright Stock	.32	.35	.32	.35	.32	.35
Waxes:						
124-126 White Crude Scale Wax	.03	.03⅛	.03	.03⅛	.03	.03⅛
PENNSYLVANIA—						
34 Neutral	.07½	.07¾	.07½	.07¾	.07½	.07¾
34 Sundebloom	.07½	.07¾	.07½	.07¾	.07½	.07¾
36 Miners' Neutral	.07¼	.07½	.07¼	.07½	.07¼	.07½
150, 3 color	.15½	.16	.15½	.16	.15½	.16
180, 3 color	.21½	.22	.21½	.22	.21½	.22
200, 3 color	.23½	.24	.24½	.25	.24½	.25
220, 3 color	.28½	.29	.28½	.29	.28½	.29
600, steam refined	.26	.26½	.26½	.27	.26½	.27
635, steam refined	.30	.30½	.29½	.30	.29½	.30
650, steam refined	.31	.31½	.31	.32	.30½	.31
600, Pennsylvania Flash	.32	.32½	.32	.33	.31½	.32
630, Pennsylvania Flash	.35	.36	.36	.36½	.36	.36½
600, E filtered	.32½	.33	.32½	.33	.33	.33½
600, D filtered	.36½	.37	.36½	.37	.36½	.37
Pennsylvania Bright Stock	.45	.46	.48	.49	.49	.50
*122-124 White Crude Scale Wax	.03	.03⅛	.03¼	.03½	.03¼	.03½
*124-126 White Crude Scale Wax	.03⅛	.03¼	.03¼	.03½	.03¼	.03½

*At New York.

GULF COAST (South Texas)—						
No. 2 color, 100 vis., pale oil	.06	.06½	.06	.06½	.05¾	.06½
No. 3 color, 200 vis., pale oil	.08½	.09	.08½	.09	.09	
No. 3 color, 300 vis., pale oil	.09¾	.10	.09¾	.10	.09¾	.10
No. 3½ color, 500 vis., pale oil	.11	.11½	.11	.11½	.11	.11½
No. 4 color, 750 vis., pale oil	.12	.13	.12	.13	.12	.13
No. 5 to 6 color, 200 vis., red oil	.07	.08	.07	.08	.07½	.08
No. 5 to 6 color, 300 vis., red oil	.08½	.09	.08½	.09	.08½	
No. 5 to 6 color, 500 vis., red oil	.09	.10	.09	.10	.09	.10
No. 5 to 6 color, 750 vis., red oil	.11½	.12½	.11½	.12½	.11¼	.11½
No. 2½ color, 200 vis., pale filtered	.11	.12	.11	.12	.11	.12

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement unless otherwise noted.

No. 2½ color, 300 vis., pale filtered	.12	.13	.12	.13	.12	.13
No. 2½ color, 500 vis., pale filtered	.14½	.15	.14½	.15	.14½	.15
No. 2½-3 color, 750 vis., pale filtered	.17	.19	.17	.19	.17	.19
CALIFORNIA—						
130 vis., 2½-3 color	.10¼	.10½	.10¼	.10½	.10¼	.10½
200 vis., 2½-3 color	.11½	.11¾	.11½	.11¾	.11½	.11¾
300 vis., 3-3½ color	.13	.13½	.13	.13½	.13	.13½
350 vis., 3½-4 color	.13½	.13¾	.13½	.13¾	.13½	.13¾
400 vis., 3½-4 color	.15	.15½	.15	.15½	.15	.15½
Red Neutral:						
200 vis., 4½-5 color	.11	.11¼	.11	.11¼	.11	.11¼
300 vis., 5-6 color	.12	.12¼	.12	.12¼	.12	.12¼
400 vis., 5-6 color	.13¼	.14	.13¼	.14	.13¼	.14
500 vis., 4½-5 color	.14¼	.15½	.14¼	.15½	.14¼	.15½
500 vis., 5-6½ color	.15	.15¼	.15	.15¼	.15	.15¼
600 vis., 6½ plus color	.16	.16¼	.16	.16¼	.16	.16¼

Note—Bright stocks are not manufactured commercially on the Pacific Coast.

NEW YORK (BAYONNE) REFINERY PRICES

	Dec. 3		Nov. 26		Nov. 19	
Gasoline, U. S. Motor, 58-60, 437	.08¾	.09	.08¾	.09	.08¾	.09
Kerosene, water white, 41-43	.07¾		.07¾		.07¾	
*Fuel Oil, Bunker "C," 14-16, per bbl.	1.05		1.05		1.05	
†Fuel Oil, Diesel, 28-30, per bbl.	2.00		2.00		2.00	
Gas Oil, 32-36 gravity	.05¼		.05¼		.05¼	
25 pale Paraffin Oil	.10½		.10½		.10½	
28 pale Paraffin Oil	.07¼		.07¼		.07¼	
285 red Paraffin Oil	.12½		.12½		.12½	
250 red Paraffin Oil	.11½		.11½		.11½	
225 red Paraffin Oil	.10		.10		.10	
200 red Paraffin Oil	.09¼		.09¼		.09¼	
Refined Wax:						
120-122 a.m.p., per lb.	.038		04		.04	
125-127 a.m.p., per lb.	.04⅛	.04¼	.04⅛		.04⅛	
130-132 a.m.p., per lb.	.04⅛		.04⅞		.04⅞	
133-135 a.m.p., per lb.	.05⅜		.05⅞		.05⅞	
135-137 a.m.p., per lb.	.06⅛		.06¼		.06¼	
Petrolatum in barrels, carload lots, per pound:						
Dark Green	.01⅞		.01⅞		.01⅞	
Amber	.03½		.03½		.03½	
Extra Amber	.03⅝		.03⅝		.03⅝	
Cream	.06⅜		.06⅜		.06⅜	
Lily White	.07⅜		.07⅜		.07⅜	
Snow White	.08⅜		.08⅜		.08⅜	

*Lighterage 5.0 cents a barrel extra. †Lighterage 6.5 cents a barrel extra.

NEW YORK (BAYONNE) EXPORT PRICES

	Dec. 3		Nov. 26		Nov. 19	
Kerosene, prime white	.07¾		.07¾		.07¾	
Kerosene, water white	.09		.09		.09	
600, steam refined cylinder stocks, in bbls.	.32½		.33		.33	
635, steam refined	.34½		.35		.35	
650, steam refined	.38½		.39		.39	
600, Pennsylvania Flash	.43		.43		.43	
630, Pennsylvania Flash	.47		.47		.47	
600, Warren E	.40		.40		.40½	
600, Oil City E	.39		.39		.39½	
Light 140-150 Bright Stocks	.57	.58	.57	.58	.59	.60
Dark 140-150 Bright Stocks	.56	.57	.56	.57	.57	.58

LOS ANGELES EXPORT PRICES

	Dec. 3		Nov. 26		Nov. 19	
Kerosene, water white	.04½	.05	.04½	.05	.04½	.05
U. S. Motor Gasoline, 53-55, 437 e.p.	.06¼	.06¾	.06¼	.06¾	.06¼	.06¾

CRUDE OIL PRICES

OKLAHOMA, KANSAS, NORTH AND EAST CENTRAL TEXAS

Oklahoma City—Same as other Mid-Continent price schedule except Empire Pipe Line Co. posts all oil 40 gravity and above at $1.65 on November 24.

Cornicana heavy (January 11)*	$ .80
Other fields	See gravity table

*Posted by Magnolia Petroleum Co.

TEXAS PANHANDLE

Gray County, Wheeler County and Carson-Hutchinson Counties—See gravity table.

WEST TEXAS

Iatan*	Same as North Texas
Crane-Upton-Crockett, Pecos, Winkler and Mitchell	See gravity table, column 3
Howard and Glasscock	See gravity table, column 11
Chalk†	$ .65

*Includes Westbrook Field.
†Posted by Humble Oil & Refining Co.

ARKANSAS-NORTH LOUISIANA

Smackover, below 24 gravity (May 20, 1929)	$ .85
Smackover, 24 gravity and above (May 20, 1929)	1.00
Cotton Valley, below 36 gravity (May 22)	.85
Bellevue (May 29, 1929)	1.30
Urania (May 21, 1929)	1.01
East El Dorado (May 22, 1929)	.85
Other fields	See gravity table

Cotton Valley crude about 36 gravity takes same gravity price schedule as shown for North Louisiana and Arkansas crude in Mid-Continent gravity price table.

Note—Smackover, Cotton Valley and Bellevue posted by Standard Oil Co. of Louisiana and Magnolia Petroleum Co.; Urania posted by Louisiana Oil Refining Corp.; East El Dorado, Magnolia Petroleum Co.

GULF COAST

Grade A (May 20)*	$1.30
Grade B	See gravity table
Jennings, La. (March 14)†	1.05
Saratoga, Batson, Dayton (March 14, 1927)‡	1.20
Refugio†	.70
Markham (March 14)‡	1.00
High Island (December 14)†	1.00

*Humble Oil & Refining Co., The Texas Company, Gulf Pipe Line Co., and Sun Pipe Line Co. †Gulf Pipe Line Co. ‡Sun Pipe Line Co. §The Texas Company. ¶Posted by Gulf Pipe Line Co.

ROCKY MOUNTAIN STATES
Ohio Oil Co.-Midwest Refining Co.
(Effective May 21, 1929)

Rock Creek, Wyo.	$1.40
Salt Creek	See gravity table
Big Muddy	$1.43
Grass Creek, heavy (July 27, 1928)	.90
Grass Creek, light	1.65
Mule Creek	1.20
Elk Basin	1.65
Lance Creek	1.65
Poison Spider (March 14, 1927)	1.00
Notches (March 14, 1927)	.65
Rex Lake (February 22)	1.10
Osage	1.65
Lost Soldier (contract, May 22)	1.05
Hamilton Dome (March 14, 1927)	.85
Pedro	1.25
Greybull	1.65
Four Bear	.85
Cat Creek (Montana) (July 27, 1928)	1.45
Sunburst (Montana) (May 23, 1929)	1.75
Torchlight	1.65
Hogback (New Mexico)	1.70

Note—Salt Creek, Osage, Cat Creek, Greybull and Hogback posted by Midwest Refining Co., and the remainder by the Ohio Oil Co. Both companies post Grass Creek light and Elk Basin.

(Continued on Page 222)

CRUDE OIL GRAVITY TABLE

Gravity—	Okla., Kans., N. C. Texas 1	No. La. and Arkansas 2	Crane, Upton, Crockett, Winkler, Pecos, Mitchell, Texas crudes, and Lea, N. Mex. 3	Stephens, Ark. 4	Wheeler (Texas Panhandle) 5	Gray County (Texas Panhandle) 6	Carson and Hutchinson (Texas Panhandle) 7	Salt Creek, Wyo. 8	Grade B and Light Crude (G. Cons.) 9	Somerset (South Central Texas) 10	Howard and Glasscock, W. Tex. 11
24 and above	....	....	....	....	....	....	....	....	....	....	....
Below 24	....	....	....	....	....	....	....	....	....	....	....
Below 25	.85	....	.70	....	....	....	....	....	1.15	....	.70
25 to 25.9	.90	....	.74	....	....	....	....	....	1.18	....	.74
26 to 26.9	.95	....	.78	....	....	....	....	....	1.21	....	.78
27 to 27.9	1.00	....	.82	....	....	....	....	....	1.24	....	.82
Below 28	....	1.00	....	.90	.90	.90	.90	....	....	....	....
28 to 28.9	1.05	1.05	.86	.94	.90	.90	.90	....	1.27	....	.84
29 to 29.9	1.10	1.10	.90	.98	.90	.95	.90	1.10	1.30	....	.86
30 to 30.9	1.15	1.15	.94	1.02	.95	1.00	.90	1.15	1.33	....	.88
31 to 31.9	1.20	1.20	.98	1.06	1.00	1.05	.90	1.20	1.36	....	.90
32 to 32.9	1.25	1.25	1.02	1.10	1.05	1.10	.95	1.25	1.39	1.05	.92
33 to 33.9	1.30	1.30	1.06	....	1.10	1.15	1.00	1.30	1.42	1.07	.94
34 to 34.9	1.35	1.35	1.10	....	1.15	1.20	1.05	1.35	1.45	1.09	.96
35 to 35.9	1.40	1.40	1.14	....	1.20	1.25	1.10	1.40	1.48	1.11	.98
36 to 36.9	1.45	1.45	1.18	....	1.25	1.30	1.15	1.45	....	1.13	1.00
37 to 37.9	1.50	1.50	....	....	1.30	1.35	1.20	1.50	....	1.15	....
38 to 38.9	1.55	1.55	....	....	1.35	1.40	1.25	....	....	1.17	....
39 to 39.9	1.60	1.60	....	....	1.40	1.45	1.30	....	....	....	....
40 to 40.9	1.65	1.65	....	....	1.45	1.50	1.35	....	....	....	....
41 to 41.9	1.70	1.70	....	....	1.50	1.55	1.40	....	....	....	....
42 to 42.9	1.75	1.75	....	....	1.55	1.60	1.45	....	....	....	....
43 to 43.9	1.80	1.80	....	....	1.60	1.65	1.50	....	....	....	....
44 and above	1.85	1.85	....	....	1.65	1.70	1.55	....	....	....	....

Column 1, Note—Magnolia Petroleum Co. posted schedule May 20, 1929, making price below 26 gravity 70 cents per barrel, 26-26.9 gravity 75 cents, 27-27.9 gravity 85 cents, 28-28.9 gravity 90 cents, 29-29.9 gravity 95 cents, 30-30.9 gravity $1.05, and 31-31.9 gravity $1.15, with balance of the price schedule as shown above. Top price of Empire Pipe Line Co., effective November 14 for Oklahoma City crude oil, is for 40° and above.

Oklahoma—Carter Oil Co., Prairie Oil & Gas Co., Sinclair Oil & Gas Co., Gypsy Oil Co., The Texas Company, May 20.

North Central Texas—Including Ranger, Mexia, Powell, Richland, Wortham, Lytton Springs, Currie, Nocona and Moran, Prairie Oil & Gas Co., Sinclair Oil Refining Co., Humble Oil & Refining Co., The Texas Company and Gulf Refining Co., May 20.

Kansas—Prairie, Sinclair, The Texas Company and Carter, May 20.

Column 2—Arkansas and North Louisiana—(Caddo, Bull Bayou, Crichton, Cotton Valley above 36 gravity, DeSoto, Haynesville, Homer and El Dorado only) May 22, Standard Oil Co. of Louisiana, Louisiana Oil Refining Co., Gulf Refining Co., Magnolia Petroleum Co., schedule applies to Pine Island, Haynesville, Bull Bayou, Louisiana and El Dorado, Ark., light crude.

Column 3—Humble Oil & Refining Co. and Magnolia Petroleum Co., May 20.

Column 4—Atlantic Oil Producing Co., Prairie Oil & Gas Co., Louisiana Oil Refining Corp., May 21, 1929.

Columns 5, 6 and 7—Humble Oil & Refining Co., Magnolia Petroleum Co., May 20, 1929.

Column 8—Midwest Refining Co., May 20, 1929. All crude over 37 gravity $1.50 per barrel.

Column 9—Humble Oil & Refining Co., May 20, 1929 (schedule ends 35 and above).

Column 10—Grayburg Pipe Line Co. and Pioneer Oil & Refining Co., April 7.

Column 11—Humble Oil & Refining Co., November 26.

CALIFORNIA CRUDE OIL PRICES
Standard Oil Co.-Union Oil Co. (Effective October 21, 1929)

Gravity—	Salt Lake, Newport, Lawndale, Los Angeles, Fullerton, Richfield, Torrance, Olinda-Brea, Alamitos Heights, Huntington Beach, Signal Hill (Nov. 8) Athens, Inglewood, Rosecrans-Dominguez, Watsonville 1	Whittier, La Habra, Coyote Hills 2	Midway-Sunset, Elk Hills, Lost Hills, Boriden, Buena Vista Hills 3	Montebello 4	Santa Fe Springs (Nov. 8) 5	Santa Maria, Coalinga 6	Wheeler Ridge, Fruitvale 7	Orcutt, Ventura, Rincon 8	Ventura Ave.* Potrero† 9	Elwood Terrace 10	Seal Beach (Nov. 4) 11
14 to 14.9	.70	.70	.50	.70	....	.50	.50	.65	.40	....	.70
15 to 15.9	.70	.70	.50	.70	....	.50	.50	.65	.40	....	.70
16 to 16.9	.70	.70	.50	.70	....	.50	.50	.65	.40	....	.70
17 to 17.9	.70	.70	.50	.70	....	.50	.50	.65	.40	....	.70
18 to 18.9	.75	.75	.56	.70	....	.56	.56	.70	.40	....	.75
19 to 19.9	.80	.80	.62	.75	....	.62	.62	.70	.40	....	.80
20 to 20.9	.85	.84	.68	.80	....	.68	.68	.70	.40	....	.85
21 to 21.9	.89	.88	.74	.85	.89	.74	.74	.85	.40	....	.89
22 to 22.9	.93	.91	.80	.90	.92	.80	.80	.87	.40	....	.93
23 to 23.9	.97	.94	.85	.95	.96	.85	.85	.90	.40	....	.97
24 to 24.9	1.01	.97	.90	.98	.98	.88	.88	.94	.40	....	1.01
25 to 25.9	1.05	1.00	.95	1.01	1.01	.91	.91	.98	.60	....	1.05
26 to 26.9	1.09	1.04	1.00	1.04	1.04	.94	.94	1.02	.60	....	1.09
27 to 27.9	1.13	1.08	1.05	1.07	1.07	.98	.97	....	.60	....	1.13
28 to 28.9	1.17	1.12	1.10	1.10	1.10	1.02	....	....	.60	....	1.17
29 to 29.9	1.21	1.16	1.16	1.13	1.15	1.06	....	....	.60	....	1.21
30 to 30.9	1.25	1.20	1.22	1.16	1.20	1.10	....	....	.60	....	1.25
31 to 31.9	1.30	....	1.28	....	1.25	1.14	....	....	.60	....	1.30
32 to 32.9	1.35	....	1.34	....	1.30	1.18	....	....	.60	....	1.35
33 to 33.9	1.41	....	1.40	....	1.35	1.22	....	....	.60	....	....
34 to 34.9	1.47	....	1.46	....	1.40	1.26	....	....	.60	1.16	....
35 to 35.9	1.53	....	....	....	1.45	1.30	....	....	.60	1.22	....
36 to 36.9	1.59	....	....	....	1.50	....	....	....	.60	1.28	....
37 to 37.9	1.65	....	....	....	1.55	....	....	....	.60	1.34	....
38 to 38.9	1.71	....	....	....	1.60	....	....	....	.60	1.40	....
39 to 39.9	1.77	....	....	....	1.65	....	....	....	.60	1.46	....
40 to 40.9	1.83	....	....	....	....	....	....	....	.60	1.52	....
41 to 41.9	1.89	....	....	....	....	....	....	....	.60	1.58	....
42 to 42.9	1.95	....	....	....	....	....	....	....	.60	1.64	....

*October 22. †Sunset Pacific Oil Co., October 26.

Kern River, Newhall-McKittrick, Mount Poso and Round Mountain 11 to 13.9 gravity 45 cents, 14 gravity and above 50 cents, effective October 2, 1929. On December 1, 1929, the Union Oil Co. posted Midway-Sunset, Elk Hills, Buena Vista, Lost Hills and Coalinga crude as follows: 11 to 13.9 gravity at 45 cents, 14 gravity and above 50 cents.

Column 1—Signal Hill, Seal Beach, Huntington Beach and Alamitos Heights crude, 14 to 32.9 gravity, inclusive; Richfield, Olinda-Brea and Fullerton, 14 to 30.9 gravity; Torrance and Inglewood, 14 to 28.9 gravity; Domingues and Athens-Rosecrans, 24 to 42.9 gravity.

Column 2—Whittier crude, 14 to 22.9 gravity; Coyote Hills, 14 to 30.9 gravity.

Column 3—Kern River, Newhall and McKittrick, 11 to 19.9 gravity; Midway-Sunset, Buena Vista and Elk Hills, 11 to 33.9 gravity; Lost Hills, 11 to 34.9 gravity; oil below 14 gravity posted at 45 cents.

Column 6—Oil below 14 gravity posted at 45 cents.

Columns 8 and 9—Posted by Union Oil Co. only.

Kettleman Hills, 55 gravity and above, $1.65 (posted by Standard Oil Co. of California).

TANK WAGON MARKETS

Tank wagon quotations for gasoline and kerosene in United States as furnished by the larger marketing concerns Dec. 3

ALL TANK WAGON AND SERVICE STATION QUOTATIONS INCLUDE TAXES

STANDARD OIL CO (INDIANA)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Chicago†	17.0	18.0	3.0	13.0
Decatur, Ill.	19.2	20.2	3.0	13.1
E. St. Louis	15 4	15 4	3.0	12.9
Joliet	19.4	20.4	3.0	13.3
Peoria	19.2	20.2	3.0	13.1
Quincy	19.2	20.2	3.0	12.9
Davenport, Ia.	19.5	20.5	3.0	13.3
Des Moines	19.5	20.5	3.0	13.3
Keokuk	19 5	20.5	3.0	13.3
Sioux City	19.1	20.1	3.0	12.9
Duluth, Minn.	20.5	21.5	3.0	13.9
Mankato	20.1	21.1	3.0	13.7
Minneapolis	20.2	21.2	3.0	13.9
LaCrosse, Wis.	19.2	20.2	2.0	14.0
Milwaukee	18 1	19 1	2.0	12.9
Madison	18.3	19.3	2.0	13 1
Detroit, Mich.	19.8	20.8	3.0	14.7
Grand Rapids	19.7	20.7	3.0	14.6
Saginaw	19.9	20.9	3.0	14.8
Evansville, Ind.	20.0	21.0	4.0	14.0
Fort Wayne	20.4	21.4	4.0	14.4
Indianapolis	20.2	21.2	4.0	14.2
South Bend	20.4	21.4	4.0	14.4
Fargo, N. D.	21.9	22.9	3.0	15.9
Huron, S. D.	21.3	22.3	4.0	14.7
Sioux Falls	20.1	21.1	4.0	14.4
K. C., Mo.*	18.9	19.9	3.0	11.6
Springfield*	18.8	19.8	3.0	12.6
St. Louis*	17.9	18.9	2.5	12.3
St. Joseph	18.5	19.5	2.0	12.2
Wichita, Kans.	17.8	18.8	3.0	11.8
Bartlesville, Ok.	18.5	19.5	4.0	11.5

*State tax 2 cents; remainder city tax.

†Effective February 20, discounts on Q.D.A. in Chicago district 2 cents off service station price on purchases of 500 gallons or more per month and 4 cents on purchases of 1,000 gallons or more per month.

NAPHTHA

	Tank wagon	Tank car
Oleum spirits	15.7	12.9
V. M. & P. Naphtha	17.2	13.9
Cleaner's naphtha	17.0	14.9
Stanisol	17.0	15.4

Tank wagon prices f.o.b. Chicago; tank car prices f.o.b. Whiting.

STANOLIND FURNACE OIL IN CHICAGO

Less than 100 gallons	9.0
100 to 349 gallons	8.0
350 gallons or more	7.5

Note—Outside Chicago furnace oil discount of 1 cent per gallon is given on deliveries of 100 to 349 gallons and 1½ cents on deliveries of 350 gallons or more.

The following quantity discounts from the service station price are allowed on monthly sales of gasoline; 2,000 gallons or less, 2 cents; more than 2,000 and less than 6,000 gallons, 2½ cents; more than 6,000 gallons, 3 cents. Discounts are allowed each month and they are not cumulative. Delivery tickets showing date and quantity delivered must be sent to the seller before the tenth of the month to secure the discount on the previous month's purchases.

SOUTHWESTERN DISTRICT

Magnolia Petroleum Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Dallas, Tex.	17.0	21.0	4.0	13.0
Fort Worth	17.0	20.0	4.0	12.0
Houston	13.0	17.0	4.0	11.0
San Antonio	15 0	19 0	4 0	11.0
El Paso	16.0	20 0	4 0	16.0
Texarkana	17.0	19.0	4.0	13.0
Muskogee, Ok.*	16.0	19.0	4.0	13.0
Okla. City*	17.0	20.0	4.0	10.0
Tulsa*	15.0	19.0	4.0	10.0
Ft. Smith, Ark.	15.0	17.0	5.0	12.0
Little Rock	19.0	21.0	5.0	13 0

*Gasoline tank wagon price to dealers 2 cents under posted tank wagon.

ROCKY MOUNTAIN DISTRICT

Continental Oil Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Denver, Colo.	18.0	21.0	4.0	15.5
Pueblo	18.0	21.0	4.0	15.5
Grand Junction	22.5	25.5	4.0	19.0
Casper, Wyo.	20 0	23 0	4 0	14 0
Cheyenne	21.0	24 0	4 0	15 5
Butte, Mont.	25.5	28.5	5.0	20.0
Helena	25.5	28.5	5.0	20.0
Salt Lake, Utah	21 0	21 0	3 5	17 0
Albu'que, N. M.	20 0	23.0	5 0	17 0
Boise, Idaho	23.5	26 5	4.0	19 0
Twin Falls	23 5	27.5	4 0	19 0

PENNSYLVANIA—DELAWARE AND PART NEW ENGLAND

The Atlantic Refining Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Pittsburgh, Pa.	15 0	*21.0	...	13 0
Philadelphia	15.0	*21 0	...	13.0
Scranton	15 0	*21 0	...	13 0
Allentown	15.0	*21 0	...	13.0
Altoona	15 0	*21 0	...	13 0
Erie	15 0	*19.0	..	13.0
Dover, Del.	18.0	20 0	3 0	13 0
Wilmington	18 0	20 0	3 0	13 0
Springf'd, Mass.	18.0	20.0	2.0	15.0
Worcester	18.0	20.0	2.0	15.0
Boston	18.0	20.0	2.0	15.0
Providence, R.I.	18.0	20.0	2.0	13.0
Hartford, Conn.	18.0	20.0	2.0	14.0
New Haven	18.0	20.0	2.0	15.0

*Includes tax of 4.0 cents. Pennsylvania tax is collected by the dealer and paid by him direct to the State. The Atlantic Refining Co. recognizes a 2-cent per gallon discount on gasoline from its posted tank wagon markets on sales to dealers for purposes of resale. The Atlantic Refining Co. also recognizes a maximum discount of 2 cents per gallon on gasoline to commercial accounts under contract for one year.

NEW YORK AND PART OF NEW ENGLAND DISTRICT

Standard Oil Co. (New York)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Albany, N. Y.	18.0	20.0	2.0	15.0
New York*	16.0	18.0	2.0	15.0
Buffalo	18.0	18 0	2.0	14 0
Rochester	18.0	20.0	2.0	14.0
Syracuse	18.0	20.0	2.0	15.0
Boston, Mass.	18.0	20.0	2.0	15.0
Augusta, Me.	20.0	22.0	4.0	15.0
Manch't'r, N. H.	20.0	22.0	4.0	15.0
Burlington, Vt.	19.0	20.0	4.0	15.0

*Prices in steel barrels.

SOUTHERN DISTRICT

Standard Oil Co. (Kentucky)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Atlanta, Ga.	20.0	22.0	4.0	16.5
Augusta	20.0	22.0	4.0	15.5
Macon	21 0	23.0	4 0	16 5
Savannah	22.0	24 0	4 0	15 5
Birm'ham, Ala.	17.0	19 0	4 0	13.0
Mobile	18 0	20 0	4 0	15.0
Montgomery	19 0	21 0	4 0	16 5
Clarks'le, Miss.	18.0	20 0	5.0	12.5
Jackson	21.0	23.0	5.0	13.0
Natchez	20.5	20.5	5.0	14.0
Gulfport	22.5	24.5	5.0	14.0
Vicksburg	20.5	22.5	5.0	14.0
Jack'ville, Fla.	22.0	24.0	6.0	14.5
Miami	23.0	25.0	6.0	15.5
Pensacola	18.0	20.0	6.0	14.5
Tampa	22.0	24.0	5.0	14.5
Lexington, Ky.	20.0	22.0	5.0	15.5
Covington	20.0	21.0	5.0	15.5
Louisville	21 0	23.0	5 0	13 0
Ashland	18.0	19.0	5.0	15.5
Catlettsburg	18.0	19.0	5.0	15.5

In addition to the state tax of 4 cents on gasoline, Montgomery has city tax of 1 cent on gasoline and one-half cent on kerosene. Kerosene prices in Georgia include 1-cent tax. In Florida, an inspection fee of 0.125 cent; in Alabama, an inspection fee of one-half cent on kerosene and one-fourth cent on gasoline. Pensacola and Mobile taxes include 1-cent city levy. Gulfport tax includes privilege tax of 2 cents in addition to state tax.

Effective April 2, price to dealers 2 cents under posted tank wagon price.

PACIFIC COAST TERRITORY

Standard Oil Co. (California)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
San Francisco	20.0	24.0	3.0	15.5
Los Angeles	19.5	23.5	3.0	15.5
Reno, Nev.	24.0	26.0	4.0	19.0
Portland, Ore.	20.5	24.5	3.0	16.5
Seattle, Wash.	20.5	23.5	3.0	16.5
Tacoma	20.5	23.5	3.0	16.5
Spokane	24.5	27.5	3.0	20.5
Phoenix, Ariz.	18.0	22.0	4.0	20.5

NEBRASKA

Standard Oil Co. (Nebraska)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Omaha	20.25	22.25	4.0	13.25
McCook	21.75	23.75	4.0	14.75
Norfolk	20.75	22.75	4.0	13.75
N. Platte	21.75	23.75	4.0	14.50
Scottsbluff	21 75	23.75	4.0	14.25

ATLANTIC COAST DISTRICT

Standard Oil Co. (New Jersey)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Atlantic City	16.0	18.0	2.0	13.0
Newark, N. J.	17.0	19.0	2.0	13.0
Annapolis, Md.	20.0	22.0	4.0	13.0
Baltimore	19.0	21.0	4.0	12.0
Cumberland	20.0	22.0	4.0	13.0
Washington	17.0	19.0	2.0	12.0
Danville, Va.	21.0	23.0	5.0	12.0
Norfolk	20.0	22.0	5.0	13.0
Petersburg	21.0	23.0	5.0	13.0
Roanoke	21 0	23 0	5.0	13.0
Richmond	20.0	22.0	5.0	13.0
Charles'n, W.Va.	19.0	21.0	4.0	13.0
Keyser	20.0	22.0	4.0	13.0
Parkersburg	19.0	21.0	4.0	12.0
Wheeling	20.0	22.0	4.0	13.0
Charlotte, N. C.	19 0	21.0	5 0	13 0
Hickory	21.0	23.0	5.0	13.0
Mt. Airy	21.0	23.0	5.0	13.0
Salisbury	19.0	21.0	5.0	13.0
Charleston, S.C.	21.0	23.0	6.0	13.0
Columbia	22.0	24.0	6.0	13.0

A 2-cent per gallon discount off the gasoline tank wagon price is offered to dealers.

OHIO

Standard Oil Co. (Ohio)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Ohio points*	19.0	20.0	4.0	†13.0

*Dealers and commercial accounts 2 cents under tank wagon.
†Service station price 15 cents.

CENTRAL SOUTH DISTRICT

Standard Oil Co. (Louisiana)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
N. Orleans, La.*	15.0	15.0	5.0	13.0
Baton Rouge	20.0	20.9	4.0	14.5
Alexandria	19.0	21.0	5.0	16.0
Lafayette†	20.0	22.0	5.0	14.0
Lake Charles†	20.5	22.5	5.0	16.0
Shreveport	19.5	21.5	4.0	15.0
Knoxv'le, Tenn.	20.0	22.0	5.0	16.0
Memphis	20.0	22.0	5.0	12.5
Chattanooga	20.0	22.0	5 0	14.0
Nashville	19.0	19.9	5.0	16.0
Bristol	21.0	22.0	5.0	14.0
Lt. Rock, Ark.	19.0	21.0	5.0	13.0

*Tax of 5 cents includes city tax of 1 cent. Louisiana Kerosene prices include 1-cent state tax and 1-cent parish tax.
†Includes 1-cent parish tax.

TANK WAGON CHANGES

November 11—Continental Oil Co. reduced the gasoline station price 3 cents in Salt Lake City, Utah, to 21 cents.

Standard Oil Co. of Kentucky reduced the gasoline tank wagon and station prices 2 cents in Macon, Ga., to 21 cents and 23 cents.

November 17—Standard Oil Co. of Indiana advanced the gasoline station price 2 cents in Madison, Wis., to 19.3 cents.

November 23—Standard Oil Co. of Kentucky reduced the gasoline tank wagon and station prices 2 cents in Birmingham, Ala., and Montgomery, Ala.

November 24.—Standard Oil Co. of Louisiana reduced the gasoline station price 2 cents in Chattanooga, Tenn., to 22 cents.

November 29—Continental Oil Co. reduced the gasoline tank wagon and station prices 1 cent in Albuquerque, N. M., to 21 cents and 23 cents.

November 30—Standard Oil Co. of New York reduced the gasoline station price 2 cents in Buffalo, N. Y., to 18 cents.

December 1—Magnolia Petroleum Co. advanced the gasoline tank wagon price 1 cent and the station price 2 cents in El Paso, Tex., to 16 cents and 20 cents.

STATE REVOKES LICENSE

CHICAGO, Nov. 30.—The State has revoked the license of the Smyth Oil Co., distributor of Barnsdall products at 4062 Peterson Avenue, this city, for failure to conform to the rules governing the operation of the state tax. The management claims the law is unconstitutional and cannot be enforced. Until the matter is settled, the company is forbidden to receive or sell gasoline or any products which is included in the license to do business.

CITIES SERVICE BUYS JOBBER

CHICAGO, No. 30.—The Cities Service Co. has purchased the Penn-Marr Petroleum Co., of Fort Wayne, Ind., large distributor of gasoline and other petroleum products. The president of the Penn-Marr company was Edward O'Rourke, Jr., leading figure in the independent industry of his state. The Penn-Marr Petroleum Co. is credited with distributing 3,000,000 gallons of gasoline annually through its stations and dealer outlets.

IRISH GASOLINE MONOPOLY

A Dublin dispatch states it is understood the Fianna Fail party in Ireland is considering a plan for a Free State gasoline monopoly.

CRUDE OIL PRICES

(Continued from Page 221)

SOUTH CENTRAL AND SOUTHWESTERN TEXAS

Luling (May 2)*	$ .90
Mirando (May 20, 1929)†	.90
Salt Flat (May 20, 1929)§	1.25
Rockdale Minerva (April 15)	
Below 28 gravity	1.25
28-38.9 gravity	1.27
39-39.9 gravity	1.29
40 and a ove	1.31
Thrall‡	...
Callihan (May 15)	1.75
Lytton Springs (Lockhart)	See gravity table
Somerset	See gravity table

*Posted by Magnolia Petroleum Co.
†Magnolia Petroleum Co., Humble Oil & Refining Co., Crown Central Pipe Line Co.
‡Thrall prices same as North Central Texas less 19½ cents per cwt. freight.
§Humble Oil & Refining Co.

EASTERN STATES

Joseph Seep Purchasing Agency
(Effective October 1, 1929)

Penna Grade Oil in New York Transit Lines (New York)	$3.05
Bradford District Oil in National Transit Lines (Pennsylvania)	3.05
Penna Grade Oil in National Transit Lines (Pennsylvania)	3.05
Penna Crude Oil in Southwest Pennsylvania Lines (West Virginia)	3.00
Penna Grade Oil in Eureka Pipe Line Lines (Pennsylvania)	2.90
Penna Grade Oil in Buckeye Pipe Line Lines (Ohio)	2.70
Cabell Grade Oil in Eureka Pipe Line Lines (West Virginia) (May 22, 1929)	1.75
Corning 35-cent Grade Oil in Buckeye Pipe Line Co.'s Line (May 22, 1929)	1.80
Corning 25-cent Grade Oil in Buckeye Pipe Line Co.'s lines (May 22, 1929)	1.90
Somerset Oil in Cumberland Pipe Line Lines (Kentucky) (Nov. 12, 1929)	1.55
Ragland Grade Oil in Cumberland Pipe Line Lines (Kentucky) (Jan. 29)	.60
Wayne district oil in Cumberland Pipe Lines	1.42

MIDDLE WESTERN STATES

Ohio Oil Co.
(Effective May 21, 1929)

Lima	$1.80
Wooster	1.90
Illinois	1.75
Indiana	1.57
Princeton	1.75
Plymouth	1.25
Waterloo (November 17, 1926)	1.35
Western Kentucky	1.68
Dundee, Mich. (Sept. 17, 1929)‖	
Same as Mid-Continent gravity scale	
Upper and Lower Traverse sands, Mich‖	
Same as Mid-Continent gravity scale	
Midland, Mich. (June 3, 1929)*	$1.70
Saginaw, Mich., Saginaw Sand (February 10)†	1.89
Saginaw, Mich., Berea Sand (February 10)†	1.79
Cumberland, Clay, Barren, Clinton and Monroe Counties, Kentucky (March 15)‡	1.50
Oil in line in Stoll Oil Refining Co. in Oil City, Ky. (Oct. 7, 1929)§	1.70
Oil Springs (Canada)¶	2.27
Petrolia (Canada)¶	2.20

*Posted by Pure Oil Co.
†Posted by Sun Oil Co.
‡Posted by Paragon Development Co.
§Posted by Stoll Oil Refining Co.
¶Posted by Imperial Oil Co., Ltd.
‖Posted by Standard of Indiana for boat shipment.

MEXICAN CRUDE

Panuco*	$ .64

*Based on tank transactions for deliveries during October and December. Price exclusive of taxes.

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Says Oil Securities Outlook Favorable

Stability for Petroleum Industry Declared in Sight. Behavior of Oil Issues in Recent Flurry Held Encouraging

Stability for the American petroleum industry is in sight, says Carl H. Pforzheimer of Carl H. Pforzheimer & Co., specialists in Standard Oil securities. With oil production declining to a point where it is at or below consumption levels, the outlook, he says, is most favorable, and the unprecedented decrease in production, with the behavior of oil securities in the recent market crash, have added to the prestige of the oil industry, he believes. Mr. Pforzheimer's statement says:

"There is little doubt that the oils have gained in prestige as a result of the stock market panic. The heavy absorption of the leading issues during the worst of the collapse was impressive and might be cited as an illustration of action speaking louder than words. It seems unlikely that the accumulation of these issues during a critical period was actuated entirely by a desire to support the market and it is logical to assume that the heavy demand was due more to confidence in values and the favorable outlook for the oil industry.

"With more normal market conditions increased attention is likely to be given to the oil situation. The oils have had a number of false starts in the last year, based on hopes of improvement in the industry as a result of the movement for conservation and restriction of production. This movement, after many disappointments, has finally been effective to the extent of reducing crude output. With demand continuing at the current or more likely an increased rate, indications are that 1930 should see a substantial draft on stocks of oil above ground.

"That this should be achieved with conservation and curtailment of production and not as a result of a natural decline in output seems favorable rather than unfavorable, from the standpoint of the safety of the huge investment in the oil business, which must be assured of an adequate supply of raw material. With the industry for the first time showing an ability to handle its production problem the outlook appears favorable."

Associated Oil

Associated Oil Co. declared regular quarterly dividend of 50 cents, payable December 31 to stock of record December 9.

Simms Petroleum

Simms Petroleum Co. has completed the retirement of $3,431,500 of three-year 6 per cent convertible gold notes, partly through exchange into stock and the balance by cash redemption. With the retirement of this issue there are no obligations ahead of the company's common stock.

The consolidated balance sheet of Simms as of September 30, 1929, showed current assets of close to $6,000,000, with current liabilities of but $762,136, leaving net working capital of $5,188,692, the ratio of current assets being better than 7 to 1.

Net income for the first nine months of 1929 before depreciation, depletion and other charges totaled $3,647,778, which was more than the $3,182,218 similarly earned in the full year 1928.

Royal Dutch

Stockholders of the Royal Dutch Petroleum Co., meeting in Amsterdam, approved an increase in capitalization from 600,000,000 to 1,000,000,000 florins and authorized the directorate to issue bonds whenever desired. An amendment was passed providing that bonds would never be issued in excess of half of the issued capital without authorization from the stockholders.

The board of directors reaffirmed the company's policy providing that shareholders would always be given the preference in any new capital issue, with the possible exception of a few instances when the board might deem it necessary to issue new capital in another way for the benefit of the company.

Southern Pipe Line

Southern Pipe Line Co. has proposed a distribution of $5 a share from capital stock reduction account. The distribution is dependent upon authorization by the Public Service Commission of Pennsylvania of the company's sale to the Manufacturers Light & Heat Co. of a system of its line no longer required in its business. Approval by stockholders is also required.

In letter to stockholders, Forrest M. Towl, president of Southern Pipe Line Co., states:

"Our company recently sold to Manufacturers Light & Heat Co. a system of lines. We retained two systems for our own use. Each system has a capacity of more than twice as much oil as we are now transporting.

"A careful study of the prospective future business of the company indicates that one of the remaining systems will

TRANSACTIONS IN OIL SHARES ON NEW YORK STOCK EXCHANGE

Quotations Compiled by Francis, Bro. & Co., Members of New York Stock Exchange, Kennedy Building, Tulsa, Okla.

1929 High	1929 Low	Week ended Nov. 27 Sales	Week ended Nov. 27 High	Week ended Nov. 27 Low	Week ended Nov. 27 Close	Stocks		Outstanding capital	Par value	Div. rate	Last paid	1926 High	1926 Low	1927 High	1927 Low	1928 High	1928 Low
42⅝	17½	1,100	22	21¾	21⅞	Amerada Corp.	(sh)	922.075	N.P.	50cQ	7-31-29	32⅞	24¼	37⅝	27⅝	43⅞	27⅛
64¾	15	No sales.				American Republics Corp.	(sh)	209.180	N.P.	.....	3-20-29	74	39⅞	82½	35½	85	51⅛
47¼	40½	No sales.				Associated Oil		$57,260.300	$25	50cQ	9-30-29	60	44¾	50¼	35	53⅜	37½
77⅞	30	7.800	41⅜	40⅝	41	Atlantic Refining		$50,000.000	$25	25cQ*	9-16-29	128⅜	97	131⅜	104	66⅜	50
49⅛	20	3 800	25¾	25⅛	25¾	Barnsdall Corp.		$45.235.650	$25	50cQ	8- 6-29	33½	23½	35½	20¾	53	20
47⅛	18	8.600	26⅝	25	26⅜	Continental Oil of Delaware	(sh)	4.741.554	N.P.	.....	3-31-27	..	..	..	..	..	..
94¾	42¼	7.400	50⅞	50⅛	50⅜	General Asphalt		$20,785.400	$100	.....	.....	94½	50	96¾	65	94⅞	68
109	23	1.800	48⅛	45¾	47	Houston Oil		$25.000.000	$100	.....	.....	72	50¼	175¾	60⅛	167	79
39⅜	17¾	1,600	24¾	24½	24⅝	Independent Oil & Gas	(sh)	1.333.572	N.P.	50cQ	7-31-29	34	19⅝	32¾	17⅝	38⅜	21¾
53	13⅛	4.900	20	19⅜	19½	Indian Refining		$12.307.370	$10	.....	5-31-24	12¾	7½	12⅛	7⅝	39⅝	9
38⅜	16½	600	22⅜	21¼	22⅜	Lago Oil & Transport	(sh)	3.992,122	N.P.	.....	5- 1-27	25⅞	16½	37¾	20½	39⅛	27¾
18	7	1,300	9¾	9½	9¾	Louisiana Oil Refining	(sh)	1,190.063	N.P.	.....	.....	19⅞	12	18⅛	10	19¾	9⅜
18½	11¼	No sales.				Maracaibo Oil	(sh)	330.000	N.P.	.....	.....	28	16½	22¾	12	25½	12½
69⅜	9¼	4,000	18¼	17	18	Mexican Seaboard	(sh)	1,276.873	N.P.	.....	12-15-20	13¾	6	9¼	3	73	4⅝
39⅞	22⅛	2,000	28¾	28⅛	28¾	Mid-Continent Petroleum	(sh)	1.857.912	N.P.	50cQ	8-15-29	37	20½	39⅜	25½	44½	25⅛
5⅛	1½	No sales.				Middle States Oil		$24,298.850	$10	.....	7- 1-23	2½	½	3¾	1⅝	7⅜	2⅜
69	40½	700	61	61	61	Pan American P. & T.		$50.084.700	$50	.....	10-20-27	76½	56⅛	65⅞	40⅛	54⅞	38¼
69¼	40½	2,500	61⅝	60	61	Pan American P. & T. "B"		$121,105.050	$50	.....	11-15-24	78⅜	56⅞	66⅜	40¼	58⅞	37¾
18½	13⅝	No sales.				Pan American Western "B"	(sh)	400,000	N.P.	.....	1-30-27	46	30	37⅞	16¾	28⅜	15½
15¼	3	700	5⅜	5	5	Panhandle P. & R.	(sh)	199.370	N.P.	.....	.....	32	4½	18⅞	8	21¾	11½
76	47½	No sales.				Panhandle P. & R. pfd.		$2,564.400	$100	37½cQ	7- 2-23	99⅜	51	83	54	108	70
47	24¼	7,200	38	36¼	38	Phillips Petroleum	(sh)	2.406,796	N.P.	37½cQ	10- 2-29	57⅜	40	60¼	36¼	53⅞	35¼
3⅜	1	300	1¼	1¼	1¼	Pierce Oil Corp.		$29,622,831	$25	.....	.....	..	..	1⅛	½	5¼	⅛
5⅞	½	400	2¾	2⅝	2⅝	Pierce Petroleum	(sh)	2,500,000	N.P.	.....	.....	7	2¼	5½	2½	7	3½
65⅝	40½	1,700x	56	55	55¾	Prairie Oil & Gas		$61.720,125	$25	50cQ*	9-30-29	60¼	48	55½	45⅝	68	46
65	45	1,900x	58⅞	58¼	58⅞	Prairie Pipe Line		$101,250,000	$25	75cQ†	9-30-29	137½	122½	190	130¾	280	172
25⅞	4	500	9	8⅝	9	Producers & Refiners		$37,438.950	$50	.....	9-15-23	20¾	11	33⅞	16¾	29⅞	16
46¾	30	No sales.				Producers & Refiners pfd.		$2.845,350	$50	37½Q	5- 1-25	41¾	30¾	50	36⅞	49⅝	41
30¾	20	5,100	23⅛	22¾	22⅞	Pure Oil		$75,959,250	$25	37½Q	9- 2-29	31	25¼	33½	25	31⅝	19
49⅝	20	800	29	28⅝	29	Richfield Oil		$47,964,650	$25	50cQ	8-15-29	27½	22	28⅝	25⅜	56	23
64	43½	3,800	53¼	52½	52½	Royal Dutch, N. Y.	(sh)	611,303	$13.40	.....	8-13-29	57⅜	47⅜	54½	44¼	64	44⅝
55	43⅜	200	45½	45½	45½	Shell Transport & Trad.		£19.654,274	£1	$1.45	7-23-29	48⅝	40½	47⅞	41⅜	57½	40⅝
31¾	19	1,800	24	23½	24	Shell Union Oil	(sh)	13,000,000	N.P.	35cQ	9-30-29	31	24	31¾	24⅝	39¼	23¼
40⅛	15	100x	23⅛	23⅛	23⅛	Simms Petroleum		$8.060.380	$10	40cQ	9-14-29	25⅝	15⅛	25⅜	14¼	27¼	18⅛
45	21	28,300	27	26⅛	26¼	Sinclair Consolidated	(sh)	5.500.000	N.P.	50cQ*	10-15-29	24⅞	15¾	22⅜	15	46¾	17⅜
111	103	700	107¾	107	107¾	Sinclair Consolidated pfd.		$16.025,250	$100	$2Q	8-15-29	99½	90	104½	97	110	102½
46½	28	2,000	33⅞	33	33⅞	Skelly Oil		$27,237,750	$25	50cQ	9-16-29	37½	26⅝	37⅜	24⅛	42⅝	25
81⅞	51½	2,400	62½	61⅛	62	Standard Oil of Cal.	(sh)	12.594.098	N.P.	62½cQ	9-16-29	63⅝	51½	60¾	50⅜	80	53
83	48	21.200	64	62½	64	Standard Oil of N. J.		$620.079.800	$25	25cQ*	9-16-29	46⅜	37½	41⅜	35⅛	59⅜	37¾
48⅛	31¾	2,900	35½	35	35⅛	Standard Oil of N. Y.		$434,094.575	$25	40cQ	9-16-29	47¼	30⅜	34½	29¾	44¼	28¾
86⅜	55½	500	61¾	59	60	Sun Oil	(sh)	1.297,627	N.P.	25cQ	9-16-29	41¾	30⅛	34⅞	30	77	31½
24	5¼	800	8	7¾	8	Superior Oil Corp.	(sh)	2.324.938	N.P.	.....	12-20-20	..	..	..	..	..	..
71⅞	50	8,500	56	54⅞	56	The Texas Corporation		$211.076.650	$25	75cQ	10- 1-29	58	48	58	45	74¾	50
23⅞	9½	400	11⅞	11½	11⅝	Texas Pacific Coal & Oil Co.		$8.380.340	$10	5A‡	1- 3-28	19½	12	18⅞	12	26⅝	12⅛
40	14	2,200	20⅛	20⅛	20⅛	Tide Water Oil	(sh)	2.191.759	N.P.	20cQ	9-30-29	39¼	27	29⅛	19	41½	19⅝
97½	85⅛	200	88	87⅞	88	Tide Water Oil 5½% pfd.		$20.705.200	$100	$1.25Q	8-15-29	103	87¼	90⅛	85	100⅛	86
23½	10	2,300	13½	13	13	Tide Water Associated	(sh)	4.796.158	N.P.	.....	8- 1-27	27	20⅞	19⅛	15¾	25	14¾
15¼	5⅛	12,500	9	8¾	9	Transcontinental Oil	(sh)	3.742.029	N.P.	.....	.....	5½	3	10⅜	3¾	14¾	7¼
57	42⅛	1,700	45⅝	45⅝	44¾	Union Oil of California		$94.798.100	$25	50cQ	8-10-29	58⅜	37¼	56½	39⅝	58	42⅜
163¾	121⅞	No sales.				Union Tank Car		$31,061.200	$100	$1.25Q	9- 3-29	120⅜	84¼	127½	94	128⅛	110
42⅞	15	1,900	23¾	22½	23½	Warner-Quinlan	(sh)	356.000	N.P.	50cQ	10- 1-29	30⅛	23½	34½	24½	44⅞	26
38	25	200	29	28¼	28¼	White Eagle Oil & Refining	(sh)	490.000	N.P.	50cQ	10-21-29	29¾	25⅛	27½	20	38	20⅛
29¾	12⅞	300	15½	15	15½	Wilcox Oil & Gas	(sh)	2,400,000	N.P.	.....	5-10-28	..	..	..	..	..	.

*Plus extra dividend of 25 cents. †Plus extra dividend of 50 cents. ‡Payable in stock. x Ex-dividend.

be sufficient to handle more than twice as much oil as will probably be offered to us for transportation. There has been little change in the amount being transported through our lines.

"Subject to approval of the Public Service Commission of Pennsylvania, directors have approved an agreement to sell to Manufacturers Light & Heat Co. one of the remaining systems for $506,391. This is at the same price per mile for the various sizes of pipe as the previous sale. In order to permit the removal of the oil from the lines without considerable loss, this sale will not be closed until about May 1, 1930."

South Penn Oil

South Penn Oil Co. declared 12½ cents extra dividend and regular quarterly dividend of 50 cents, both payable December 30 to stock of record December 14.

Gulf Oil

Gulf Oil Corp., according to a Pittsburgh report, will spend approximately $75,000,000 in 1930 for refining, construction, production and expansion of marketing facilities.

Warner-Quinlan

Warner-Quinlan Co. has declared the regular quarterly dividend of 50 cents, payable January 2, 1930, to stock of record December 12, 1929.

Honolulu Oil

Honolulu Consolidated Oil Co. declared extra dividend of 50 cents and regular quarterly dividend of 50 cents, both payable December 16 to stock of record December 10.

Pure Oil

Pure Oil Co. declared the regular quarterly dividends of $2 on 8% preferred, $1.50 on 6% preferred and $1.25 at this time on the 5¼% preferred, all payable January 2 to stock of record December 10.

CONSIDERING CRUDE PURCHASE

MUSKEGON, Mich., Dec. 3.—The Old Dutch Refining Co., largest of four refining plants at Muskegon, has been negotiating for the purchase of additional pipe line facilities and crude oil supplies in the western Michigan field.

Ernest L. Hughes, head of the Hughes Oil Co., of Chicago, and vice president of the Old Dutch company, and John Borden, secretary-treasurer, of the refining company, were Muskegon visitors last week during negotiations.

No deal had been closed but it was known that the company is desirous of increasing its crude supply now limited by the declining production of the Muskegon Field. The company's plant has a capacity of 3,500 bbls. and is one of the most modern plants of its kind in the country today. Its special product is naphthas for the paint and varnish trade.

INDEPENDENT OILS ON NEW YORK CURB

Quotations Compiled by Francis, Bro. & Co., Members of New York Curb Market, Kennedy Building, Tulsa, Okla.

1929 High	1929 Low	Week ended Nov. 27 Sales	High	Low	Close	Stocks—		Outstanding capital	Par value	Div. rate	Last paid	1926 High	1926 Low	1927 High	1927 Low	1928 High	1928 Low
.72	⅛	600	⅛	⅛	⅛	Amer. Con. Oilfields		$11,018,000	$5	.....	.....	$6.75	.45	2⅛	.55	1½	.53
8⅝	1⅛	400	1¾	1¾	1¾	Amer. Maracaibo	(sh)	700,000	N.P.	.....	.....	..	..	7½	2¾	9½	3⅛
5	1⅛	No sales.				Argo Oil	(sh)	683,971	$10	.....	.....	..	..	2¾	1	4½	2¼
62	7⅞	No sales.				British-American	(sh)	1,311,321	N.P.	25cQ	10- 1-29	85¼	60	40	20½	55	32⅝
4⅞	1	5,600	1⅛	1	1⅛	Carib. Syndicate		$131.250	25c	.....	.....	28⅜	9¼	28¼	15½	4½	3⅞
68½	20	38,100	29	27	29	Cities Service	(sh)	24,290.359	N.P.	30cQ*	11- 1-29	..	..	58¾	40¼	90⅞	54
98¾	84	500	90	89⅝	90	Cities Service pfd.	(sh)	1,500,000	N.P.	50cM	11- 1-29	..	..	95⅜	87	103½	94½
2	⅜	9,000	7/16	⅜	⅜	Colombia Syndicate		$2,000.000	$1	.....	.....	3½	1¾	3⅞	1⅛	3¼	.76
11⅛	2½	No sales.				Cons. Royalty		$5,000.000	$10	15cQ	.....	..	..	9¾	6⅜	8⅞	6¼
11¾	5⅝	9,100	6⅞	6⅝	6¾	Creole Syndicate	(sh)	5,977.873	N.P.	.....	.....	16	10	14⅞	9½	17½	9½
2½	⅝	100	¾	¾	¾	Crown Central	(sh)	578.000	N.P.	.....	.....	..	..	3	.50	3¼	.76
26	6½	200	9	9	9	Darby Petroleum	(sh)	1,019,392	N.P.	25cQ	10-15-29	7⅞	6¾	12	4	33½	3¼
26	2	600	5⅜	5¼	5¼	Derby Oil & Refining	(sh)	500.000	N.P.	.....	.....	..	..	2½	74	2¼	1
44	20⅞	No sales.				Derby Oil & Refining pfd.	(sh)	48,500	N.P.	.....	.....	..	..	16¾	4	21⅛	7½
209	115	1,500	134¾	132½	132½	Gulf Oil Corp.	(sh)	4,504.921	$25	37½cQ	10- 1-29	98	92	118	86¼	165	101⅛
2⅞	⅜	800	⅞	¾	¾	Intercontinental Pet.		$5,682,000	$5	.....	.....	$3.00	.83	2½	.80	3⅜	1
3⅝	1¼	No sales.				Kirby Petroleum	(sh)	750,000	N.P.	.....	.....	..	..	2¼	1⅛	3	1¼
6⅛	2	400	2⅜	2	2	Leonard Oil & Dev.		$50,000.000	$25	.....	.....	12¼	5¾	10⅞	5⅛	9⅜	5⅛
38⅞	18	100	23	23	23	Lion Oil & Refining	(sh)	250.000	N.P.	50cQ	10-27-29	27	20	27½	20	43⅞	20
67⅞	28	100	33¾	33¾	33¾	Lone Star Gas	(sh)	5,000.000	N.P.	20cQ	9-30-29	46	30	59⅜	37	69⅛	48½
1¼	¼	No sales.				Magdalena Syndicate	(sh)	850.000	$1	.....	.....	2⅞	1	2⅞	.80	1⅞	.50
38½	17¾	No sales.				Margay Oil	(sh)	160,000	N.P.	50cQ	10-10-29	34	12½	52	12	48½	32
6⅜	2½	100	3⅛	3	3⅛	Mexico-Ohio Oil		.....	...	.....	.....	8	5½	12⅛	5	8	2¾
1½	¼	100	⅝	⅝	⅝	Mountain & Gulf		$4.000.000	$1	2cQ	10-15-29	1¾	1⅛	1½	1	1¾	.76
22⅞	7	No sales.				Mountain Producers		$1,682,182	$10	40cQ	10- 1-29	26	23	29¼	22¾	28⅞	19½
5	2¼	100	3⅜	3⅜	3⅜	New Bradford Oil		$1,095.291	$5	12½cQ	10-15-20	6⅝	5	5⅞	4⅝	5⅝	4¼
9⅜	2¼	No sales.				New Mex. & Arizona		$1.000.000	$1	.....	.....	..	..	16	9¼	11⅞	7⅛
18½	8¾	No sales.				North Central Texas	(sh)	400,000	N.P.	15cQ	9- 3-29	..	..	12¾	9½	14¼	8½
3½	½	700	¾	11/16	11/16	Pandem	(sh)	489.875	N.P.	.....	.....	10⅛	5⅞	9⅜	3¼	6	2⅛
10¼	2⅝	400	3¾	3⅝	3⅝	Pantapec Oil	(sh)	1,506,600	N.P.	.....	.....	12¼	11¾	12⅛	7	15⅝	8½
7¾	4⅜	No sales.				Pennok Oil	(sh)	150,000	N.P.	.....	.....	22¾	12	13½	5⅛	7¾	4⅞
16	9⅝	No sales.				Red Bank Oil	(sh)	250.000	N.P.	.....	.....	17	8½	24⅜	7	18	4⅞
8½	1⅛	200	3	3	3	Reiter-Foster	(sh)	388.584	N.P.	10cQ	9- 1-29	30¼	12	15½	3½	12⅞	4⅛
11	3	400	4⅛	3¾	4⅛	Ryan Consolidated	(sh)	500,000	N.P.	.....	.....	7	4½	7	4½	12	4⅛
5⅞	1⅞	700	2	2	2	Salt Creek Consolidated	(sh)	1,286.300	$10	10cQ	10- 1-29	10	7⅛	8	5¼	7¼	5½
25⅞	9	800	12⅝	11¾	11¾	Salt Creek Producers	(sh)	1,496.859	$10	50cQ	11- 1-29	35	24⅛	35½	27¼	35	23⅛
2½	8/16	200	1⅜	1¼	1⅜	Savoy Oil		$750.000	$5	.....	.....	6⅞	1¼	7	1¼	3½	1
145	82	No sales.				Transcontinental pfd.	(sh)	157,500	$100	.....	.....	92	63½	92	63½	93¼	75
6½	1¾	1,000	2⅜	2⅛	2⅜	Venezuelan Petroleum	(sh)	755.090	$5	5cQ	8-15-29	8	4½	7⅜	4¼	9½	4¾
9½	2	1,100	3½	3½	3½	Woodley Petroleum		$500,000	$1	.....	.....	8½	5½	7	4¾	8¼	4⅞
2⅞	½	1,900	⅞	⅝	⅞	"Y" Oil & Gas (new)	(sh)	100.000	N.P.	.....	.....	6½	6	6	1¾	8⅜	2⅛

*Including extra in stock.

STANDARD OIL STOCKS ON NEW YORK CURB

Quotations Compiled by Francis, Bro. & Co., Members of New York Curb Market, Kennedy Building, Tulsa, Okla.

1929 High	1929 Low	Week ended Nov. 27 Sales	High	Low	Close	Stocks—	Outstanding capital	Par value	Div. rate	Last paid	1926 High	1926 Low	1927 High	1927 Low	1928 High	1928 Low
18	14	46,700x	17	16⅝	17	Anglo-American Oil	£4.192.635	£1	.....	6- 5-29	21	16	21⅝	17⅞	22⅜	14⅞
46½	25	150	27¾	25¼	27¾	Borne Scrymser	$1.000.000	$25	$18.A.	10-15-29	76	65	69	50	56½	44½
74¼	55	800	68¼	65½	68¼	Buckeye Pipe Line	$10.000.000	$50	$1Q	9-14-29	59½	42	60	45	76	53
210	130	200	144¾	144¾	144¾	Chesebrough Mfg.	$3.000.000	$25	$1Q*	9-30-29	82½	65	126	76½	161	117
29	8	No sales.				Continental Oil	$36,057.840	$10	.....	12-15-27	25⅞	17½	22⅝	16¼	23	16
95	40	200x	43	43	43	Cumberland Pipe Line	$1.500,000	$50	$1Q	9-15-29	137	102	137	89	114	67
70½	42	150	43	43	43	Eureka Pipe Line	$5.000,000	$100	$1Q	11- 1-29	63¾	43	68½	47	88	64⅛
6⅝	5	No sales.				Galena Signal Oil	$16,000.000	$100	.....	.....	32½	9⅞	13½	3½	13	4¼
128	72½	1,300	89½	88⅝	89	Humble Oil & Refining	$74,103.300	$25	30cQ†	10- 1-29	68½	52	68½	54	114¾	59¼
340½	260	1,600	310	284	310	Illinois Pipe Line	$20,000,000	$100	$10S.A.	6-15-29	144½	125½	182	123¾	290½	176½
41	22	1,500	28	27¼	27⅞	Imperial Oil Co., Ltd.	26,421,768	N.P.	12½cQ	9- 3-29	..	..	64¾	37¾	104	56¾
35¾	26	1,500	42¼	35	39¼	Indiana Pipe Line	$3,000,000	$10	50cQ‡	11-15-29	72½	58	94½	61	91⅞	74⅜
30⅜	15	500	22⅜	22	22	International Pet.	14.247.088	N.P.	12½cQ	6-25-29	35½	28¾	29	28¼	55	35
25⅞	10½	2,400x	22⅛	20⅝	22⅛	National Transit	$6.362.500	$12.50	25cQ	9-26-29	20¾	12½	24	13½	32⅜	19⅜
16	10	No sales.				New York Transit	$1.000.000	$10	40cQ	10-15-29	51½	27¼	44½	31¼	75	38½
63	45	No sales.				Northern Pipe Line	$2.000.000	$50	$2S.A.	7- 1-29	80½	64	100	70	69	56½
79⅞	64⅛	1,000	71	68⅞	71	Ohio Oil	$60.000.000	$25	50cQ‡	9-16-29	67¾	53¾	67⅞	52	84	58½
44½	21	No sales.				Penn Mex. Fuel	$10,000.000	$25	50cQ	12-15-28	24¾	15	39	12	84	28
50	33	200x	36½	33½	36½	Solar Refining	$4.000.000	$25	$1.25S.A.	6-20-29	..	..	..	..	..	..
22½	13	100x	15	15	15	Southern Pipe Line	$1.000.000	$10	50cQ	.....	74½	61½	27¼	15½	19	15
60¼	35⅛	300	41⅞	41½	41⅞	South Penn Oil (new)	$30.000.000	$25	50cQ	9-30-29	50	34½	41½	35	71⅞	36¾
70	60	No sales.				Southwest Pa. Pipe Lines	$1,750.000	$50	$1Q	10- 1-29	56	47½	83	55½	102	70
63	45	13,200	53½	53	53⅜	Standard Oil of Indiana	$348.175.069	$25	62½cQ	9-16-29	70½	60½	81½	64⅝	95⅞	70⅞
33¾	18	100x	27½	27½	27½	Standard Oil of Kansas	$8.000.000	$25	.....	6-16-24	36½	16½	20⅞	14⅝	37¾	15
46⅞	29	1,600	36⅝	35¾	36	Standard Oil of Kentucky	$25.654.516	$10	40cQ	9-30-29	134⅜	108	130	111½	179¾	122¼
50¼	45	No sales.				Standard Oil of Nebraska	$4,649.225	$25	62½cQ‡	9-30-29	51½	42	49½	40	54⅞	39⅞
129	60	150	87½	87½	87½	Standard Oil of Ohio	$14.000,000	$25	62½cQ	10- 1-29	372	288	87½	72	134	71
18	10	No sales.				Swan-Finch Co.	$861,466	$25	.....	1-15-29	21	15	21	14½	23½	16
133¾	75	1,600x	96	94¾	94¾	Vacuum Oil Co.	$126,180,350	$25	$1Q	9-30-29	109⅜	90¼	..	..	111	72

*Plus 50 cents extra. †Plus 20 cents extra. ‡Plus 25 cents extra. x Ex-dividend.

WEST TEXAS FIELDS

(Continued from Page 85)

16 and 17 is north and south, 2,490 feet north and 1,470 feet west of Section 17, Block 5, topped the salt at 745 feet, topped the pay at 2,470 feet, was drilled to a total depth of 2,500 feet, was shot with 100 quarts at 2,465-2,500 feet and with 300 quarts at 2,465-2,500 feet and had an initial production of 100 bbls. daily.

Winkler County

Southern Crude Oil Purchasing Co.'s No. 4 Hutchings T-90, located 2,310 feet south and east of Section 47, Block 26, topped the lime at 2,242 feet, topped the pay at 2,810 feet, was shot with 345 quarts at 2,765-2,965 feet and had an initial production of 283 bbls. pipe line oil.

DAILY AVERAGE PRODUCTION BY LEASES

WINKLER COUNTY
Week Ending November 26

Company, farm, section, block—	Wells	Prod.
Amerada Pet. Corp.:		
Cowden, 3, B-12	3	36
Atlantic O. P. Co.:		
Hendricks-A, 34, B-5	7	2,300
Hendricks-B, 44, 26	6	650
Hendricks-D, 29, B-5	8	575
Hendricks-E, 41, B-5	6	778
Hendricks-G, 46, 26	7	15
Atlantic O. P. Co.:		
Hendricks-F, 40, 26	12	715
Bankers Prod. Co.:		
Hendricks, 30, B-5	1	0
V. T. Bolin:		
Brown-Altman, 4, B-5	1	4
California Co.:		
Hendricks, 29, B-5	7	610
Continental Oil Co.:		
Hendricks, 33, 26	4	663
Hendricks-A, 29, 26	2	82
Hendricks-B, 34, 26	2	48
Cranfill & Reynolds:		
Hendricks-A, 28, B-5	2	257
Hendricks-B, 33, B-5	1	68
Hendricks-C, 33, 26	2	444
Hendricks-E, 33, 26	2	135
Cranfill & Texon:		
Hutchings, 47, 26	2	275
Culberson Brothers:		
Hendricks, 40, B-5	1	60
Eastland Oil Co.:		
Hendricks, 35, B-5	2	270
Hendricks-B, 46, 26	1	118
Gulf Prod. Co.:		
Hendricks-A, 34, B-5	13	4,600
Hendricks-B, 45, 26	11	3,135
Hendricks-C, 40, B-5	6	435
Hendricks, 44, 26	3	450
Cowden, 3, B-12	3	115
Humble Oil & Ref. Co.:		
Hendricks-A, 34, B-5	17	4,426
Hendricks-B, 29, B-5	6	1,785
Hendricks-C, 32, 26	8	480
Hendricks-D, 41, 26	1	0
Hendricks-B, 39, 26	3	207
Hendricks-C, 10, B-12	13	6,720
Walton-A, 48, 26	1	100
Independent Oil & Gas:		
Hendricks-A, 34, B-5	7	875
Howe-B, 44, 26	3	120
McCabe, 36, B-5	2	155
Vardeman-B, 41, B-5	6	275
Lion Oil Co.:		
Hendricks-A, 41, B-5	11	1,615
Hendricks-B, 34, B-5	13	2,938
Hendricks-C, 45, 26	14	4,515
Hendricks-D, 44, 26	1	70
Magnolia Pet. Co.:		
Hendricks, 29, B-5	8	450
May Prod. Co.:		
Hendricks, 34, 26	1	10
American Maracaibo:		
Hendricks-A, 28, B-5	1	28
Hendricks-B, 28, B-5	1	31
Mining & Engineering:		
Hendricks, 10, B-12	1	0
Murchison & Cranfill:		
Hendricks-A, 35, B-5	5	263
Hendricks-B, 35, B-5	3	402
Hendricks-C, 35, B-5	1	0
Hendricks-H, 35, B-5	1	625
Hendricks-I, 34, 26	1	120
Republic Production Co.:		
Hendricks-A-B, 45, 26	12	1,325
Hendricks-C, 41, B-5	5	87
Prairie Oil & Gas Co.:		
Hendricks, 40, 26	6	1,537
Cowden, 3, B-12	6	1,830
Shell Pet. Corp.:		
Hendricks-A, 45, 26	5	498
Hendricks-B, 29, B-5	5	1,910
Hendricks-C, 29, B-5	7	323
Hendricks-D, 41, B-5	3	115
Hendricks-E, 40, B-5	3	378
Hendricks-F, 46, 26	6	230
Hendricks-G, 39, 26	1	65
Shell-Texas Co.:		
Cowden-A, 3, B-12	6	1,985
Hendricks, 45, 26	6	2,430
Hendricks-A, 29, B-5	7	765
Hendricks-B, 40, 26	4	231
Hendricks-C, 40, 26	6	1,285
Hendricks-D, 40, 26	6	210
Hendricks-E, 39, 26	2	122
Skelly Oil Co.:		
Hendricks, 40, 26	12	1,210
Hendricks-B, 10, B-12	2	19
Hendricks-C, 39, 26	1	77
Southern Crude O. P. Co.:		
T-67 Hendricks-A, 42, B-5	3	120
T-67 Hendricks-3-A, 4, B-12	5	375
T-67 Hendricks-B, 44, 26	5	280
T-67 Hendricks-3-B, 33, 26	4	456
T-67 Hendricks-C, 33, B-5	5	440
T-67 Hendricks-2-D, 27, 26	5	955
T-67 Hendricks-E, 42, B-5	4	92
T-67 Hendricks-F, 33, B-5	5	480
T-68 Hendricks-3-A, 35, B-5	3	100
T-68 Hendricks-B, 46, 26	2	100
T-88 Hendricks-A, 44, 26	6	600
T-88 Hendricks-B, 4, B-12	4	140
T-88 Hendricks-C, 28, B-5	8	975
T-88 Hendricks-D, 4, B-12	5	2,065
T-88 Hendricks-H, 28, B-5	6	780
T-88 Hendricks-I, 20, B-5	7	385
T-88 Hendricks-J, 30, B-5	5	450
T-88 Hendricks-K, 41, 26	7	1,000
T-88 Hendricks-L, 4, B-12	4	430
T-88 Hendricks-M, 33, 26	33	10,355
T-88 Hendricks-N, 28, 26	7	2,190
T-88 Hendricks-O, 22, 26	4	357
T-88 Hendricks-P, 28, 26	2	310
T-88 Hendricks-Q, 27, 26	2	820
T-88 Hendricks-R, 27, 26	3	783
T-88 Hendricks-S, 34, 26	4	1,580
T-88 Hendricks-T, 34, 26	7	960
T-88 Hendricks-U, 41, 26	10	1,120
T-88 Hendricks-V, 29, 26	1	72
T-88 Hendricks-W, 5, B-12	1	210
T-88 Hendricks-CX, 21, 26	4	1,000
T-89 Hendricks-A, 35, B-5	3	135
T-89 Hendricks-B, 35, B-5	2	405
T-89 Hendricks-C, 35, B-5	3	540
T-89 Hendricks-D, 35, B-5	1	155
T-89 Hendricks-E, 40, B-5	3	98
T-89 Hendricks-F, 40, B-5	2	190
T-89 Hendricks-H, 46, 26	2	135
T-89 Hendricks-I, 10, B-12	2	52
T-89 Hendricks-J, 9, B-12	8	630
T-89 Hendricks-L, 15, B-12	2	1,075
T-90 Hutchings, 47, 26	2	418
Texon Oil & Land Co.:		
Hendricks-A, 41, B-5	6	75
Hendricks-B, 45, 26	6	1,587
Total Hendricks Pool	566	58,235
Leck Area		
Atlantic, Kessler & Logan:		
Leck, 3, 74	2	130
Amerada Pet. Corp.:		
Leck, 3, 74	2	290
Empire Gas & Fuel Co.:		
Daugherty, 3, 74	3	150
Magnolia Pet. Co.:		
Scarborough, 1, C-22	2	165
Gulf Prod. Co.:		
Scarborough, 1, C-22	1	69
Daugherty, 3, 74	1	540
Shell-Llano Oil Co.:		
Daugherty, 1, C-22	5	287
Shell-Danciger:		
Daugherty, 3, 74	2	67
Skelly Oil Co.:		
Daugherty, 22, 16	4	1,207
Tidal Oil Co.:		
Scarborough, 1, C-22	1	53
Prairie Oil & Gas Co.:		
Leck, 16, 74	1	490
Daugherty, 3, 74	1	134
Scarborough, 1, C-22	1	62
Warner-Quinlan:		
Leck, 3, 74	1	404
Total Leck Pool	27	4,082
O'Brien Pool		
Continental Co.:		
Morton-A, 10, B-12	1	85
Morton-B, 10, B-12	2	116
Wentz Oil Corp.:		
Morton, 10, B-12	1	130
Simms Oil Co.:		
Sealy, 50, F	1	26
Richardson et al:		
Stockton, 50, F	1	65
Total O'Brien Pool	6	422
Grand total Winkler County	598	102,739

PECOS COUNTY
Week Ending November 26

Company, lease—	Wells	Bbls.
M. H. Black:		
Fee	1	10
California Co.:		
Yates—Lease 1	19	10,910
Smith—Lease 1, Sec. 37	4	590
Smith—Lease 1, Sec. 23	8	2,277
Smith—Lease 1, Sec. 21	5	998
Smith—Lease 2	3	105
Smith—Lease 3	13	2,165
Smith	2	23
Tippett—Lease 1	1	30
University	1	65
Continental Oil Co.:		
Yates-A	8	497
Salvage		5,119
University-A	3	745
Cosby Drilling Co.:		
Smith	2	590
Dorn & McGee:		
Pecos Valley	1	22
Grayburg Oil Co.:		
Pecos River Bed	6	328
Salvage		198
Gulf Production Co.:		
All leases	42	16,895
Henshaw Oil Corp.:		
University	1	45
Humble O. & R. Co.:		
Smith-A	11	2,075
Smith-B	7	1,097
Kirby Pet. Co.:		
Tippett	2	60
Kirby Pet. and Edson:		
Tippett	1	230
McCarty Oil Co.:		
Gray	1	11
Bennett	1	...
McMan O. & G. Co.:		
Smith-A	1	1,765
Smith-B	4	1,445
Smith-C	9	866
Tippett	3	415
Richardson	2	170
McMan and Continental:		
Yates	17	5,447
Mid-Kans. and Transcontinental:		
Yates-A	28	21,722
Yates-B	27	7,310
Salvage		240
Yates-C	11	8,522
Salvage		172
Yates-D	7	8,162
Yates-E	3	875
Yates-F	4	852
Yates-G	3	1,327
Yates-H	10	9,103
Smith	6	2,585
Smith-Taylor	19	4,372
Landreth Prod. Co.:		
University-A	2	662
University-C	2	1,260
University-D	2	47
University-G	2	893
University-H	1	23
Landreth and Weald:		
University-B	5	3,880
J. D. O'Mara:		
Butz	1	11
Pecos Valley Oil:		
Fee, Sec. 22, Blk. 26	2	46
Phillips Pet. Corp.:		
Monroe	2	180
Ramsey	4	950
Smith	3	660
Plymouth Pet. Corp.:		
Perry	1	32
Red Bank Oil Co.:		
Smith	5	490
Rowan-Tong and Independent:		
McDonald	1	...
Savoy and Mazda:		
Smith	3	620
Shell Pet. Corp.:		
Tippett	11	3,160
Smith-A	11	1,415
Smith-B	1	670
Smith-D	4	813
Smith-E	1	30
Bower-University-C	4	820
Simms Oil Co.:		
Smith	7	7,016
Skelly Oil Co.:		
Tippett	2	222
Taylor Link:		
University	6	505
World Oil Co.:		
University	1	55
Total Pecos Field	381	144,886

EAST CENTRAL TEXAS

(Continued from Page 91)

east part of the Thomas Quevedo Survey. The company is planning to drill more core tests on this area, and will probably follow these with a deep test on one of its leases.

Humble Oil & Refining Co.'s No. 1 Birdwell, 500 feet from south and west of the Birdwell tract in the northwest part of the S. Bowlin Heirs' Survey, Anderson County, which topped the chalk at 3,150 feet with a surface elevation of 420 feet, is running about 300 feet high, therefore showing a domal condition. This is northwest of the Boggy Creek Dome, and if this test is dry, there will no doubt be other tests drilled on this dome to give it a thorough testing.

Boggy Creek Producer

The first producer of any size completed at Boggy Creek, Anderson and Cherokee Counties, in several months was brought in by Humble Oil & Refining Co. in its No. 3-B Elliott & Clark, which flowed initially at 28 bbls. an hour on a five-sixteenths inch choke from sandy shale at a total depth of 3,609 feet. The well is estimated good for 500 bbls. daily. This well is on the northernmost edge of production, which so far was confined to the southeast side. This well is in the Garcia Survey on the Cherokee County side on the Neches River. The main production is in Anderson County, but extensions are being made along the edge of the dome both to the northward and to the southwest.

Humble's No. 2 Gauger on the extreme southwest end of production is drilling hard, sandy shale at 3,498 feet. No. 3-A Jones is drilling chalk at 3,508 feet; No. 3 Tom Jones, Jr., is drilling chalk at 3,374 feet; and No. 1-B Todd is standing temporarily at 2,595 feet, pending checking the straightness of the hole. Humble's No. 4 Lizzie Smith, formerly abandoned temporarily at 3,682 feet, now is being deepened and is drilling gray sand at 3,695 feet. A derrick is up for No. 5 Earle & Ragsdal.

On the Posey Saline, also Anderson County, Humble's No. 1 E. B. Birdwell is drilling hard shale at 3,420 feet.

In Falls County, Griver and associates' wildcat, No. 1 Westbrook, has 150 feet of oil standing in the hole from the Buda lime at 927 feet after running tubing. The well probably will be put on the pump for a small producer. Haley & Young's No. 1 Knight, Freestone County, is trying to plug off bottom water at 4,806 feet.

Killiam & Phillips' No. 1 Scramalde, Robertson County, is drilling shale at 1,160 feet. Magnolia Petroleum Co.'s No. 1 Duran, Lollar Survey, Rusk County, is drilling lime and shale at 3,881 feet.

In Navarro County, Haskell & Brooks' No. 1 Morrow probably will make a small pumper from sand at 3,205-06 feet. It bailed a quantity of fluid, 90 per cent water and 10 per cent oil. O'Bryne and associates' No. 1 Bush, same county, also is in shale showing oil at 2,210 feet and has cemented 6⅝-inch casing at 2,050 feet.

C. F. Lytle's No. 2 Thompson, Limestone County, Mexia deep test, is standing at 4,345 feet with oil gradually coming into the hole after being bailed dry a couple of weeks ago. Why Not Oil Co.'s No. 3 Rhea, Mexia Woodbine test, is drilling shale and lime at 1,150 feet.

PRODUCTION BY POOLS

Boggy Creek	3,260
Cedar Creek	70
Currie	390
Hill County	48
Mexia	4,911
Minerva	500
Nigger Creek	235
Powell	6,751
Richland	280
Thrall	37
Van	260
Wortham	965
Total	17,807
Week ending November 23	17,674
Increase	131

DIAMOND DRILLS USED TO COMPLETE WELLS

(Continued from Page 58)

square inch in 3,000 or 4,000-foot holes experience shows that it is quite feasible to overcome this pressure with heavy circulating fluid containing barium sulphate which can be built up to a specific gravity of 1.5 to 1.8. When it is possible to do this drilling is carried on in the usual manner and the pressure control apparatus is used only in emergencies.

"When pressures exceed 2,000 pounds per square inch, experience shows that the gas works its way into the column of mud fluid, thus reducing its specific gravity and causing the whole column to be blown out of the hole. When these blow-outs occur with aqueous solutions in the hole, the very low temperatures resulting from the expansion of the gas in the bottom of the hole causes ice to form, freezing the drilling string in the hole.

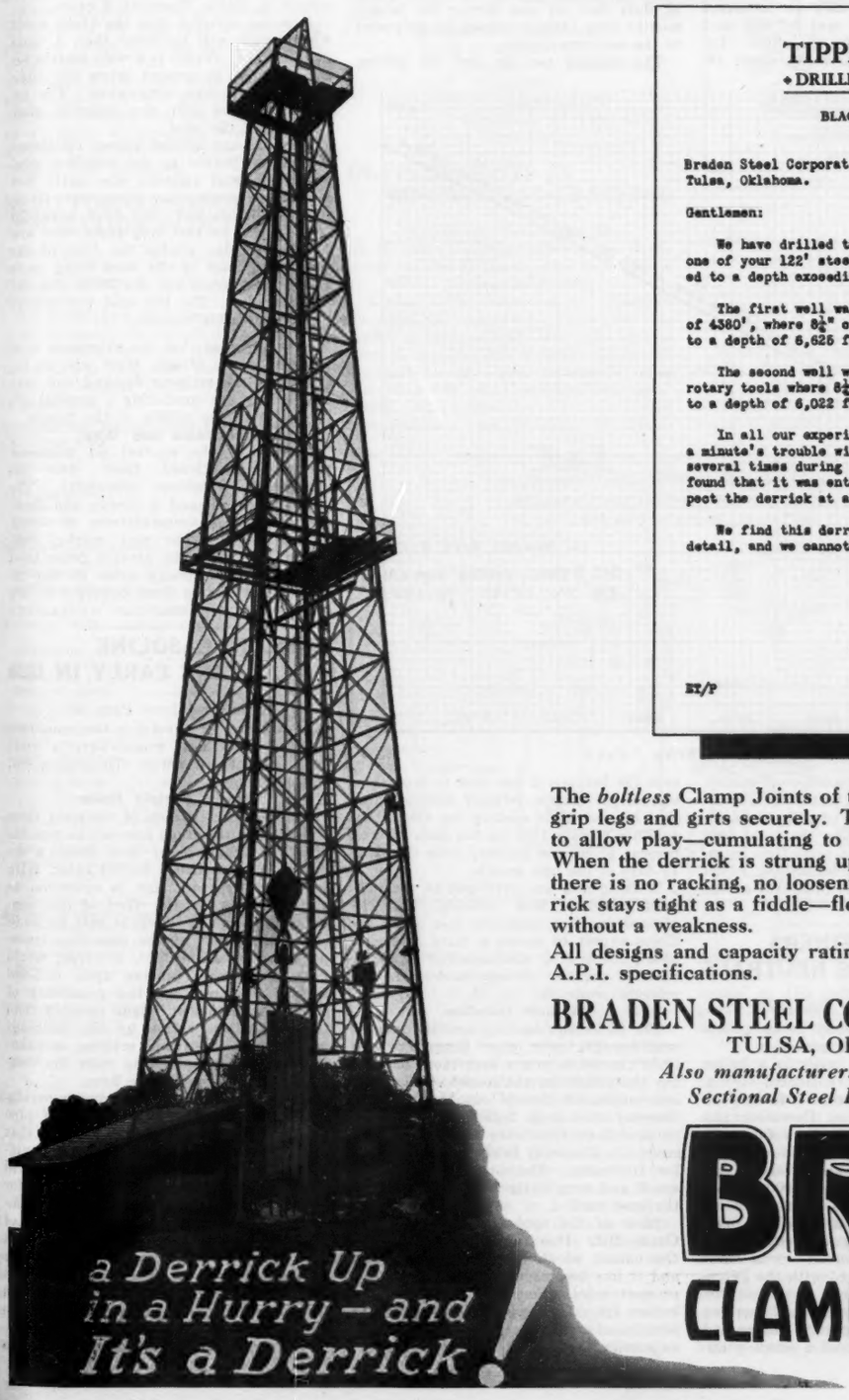
"When drilling into these high pressures it has been found safer to circulate oil instead of mud. The idea in this case is to make no effort to prevent the gas from blowing as soon as it is struck. With the pressure control apparatus installed as described above, oil is pumped from the sump down through the rods, is picked up by the gas at the bottom of the hole and blown out, passing through the separator. From this the oil is conducted back to the sump and the gas is conducted out 300 or 400 feet into the field and burned or disposed of in some other manner.

"It is necessary to make careful preparation before striking the gas. All the aqueous solution must be thoroughly removed from the sump and replaced with oil. The slightest amount of water in the oil will cause the drilling string to become frozen, due to the very low temperature caused by the expanding gas in the bottom of the hole. The oil does not freeze at these low temperatures and it has the further advantage of keeping everything well lubricated in the hole.

"A check valve is installed in the drilling string close above the bit to prevent the gas from blowing out through the drill pipe coming out of or going into the hole. When coming out of the hole the drilling string is removed in the ordinary manner until the bit has cleared the drilling valve above the cross in the cellar. The drilling valve is then closed to prevent the gas from blowing up into the derrick and the rod brake and oil savers are then taken apart, to remove the bit.

"By this means it is quite feasible to drill, go in and come out of the hole and carry on all operations while volumes up to 20,000,000 feet of gas under pressure up to 3,500 pounds per square inch are passing through the separator. All fittings used in the assembly must be designed to withstand the pressures to be encountered with an ample margin of

"Inspection Unnecessary" on the Derrick that STAYS TIGHT



TIPPETT & BOND
◆ DRILLING CONTRACTORS ◆

BLACKWELL, OKLAHOMA
February 1, 1929

Braden Steel Corporation,
Tulsa, Oklahoma.

Gentlemen:

We have drilled two deep-test wells in Logan county with one of your 122' steel rotary derricks. Both wells were drilled to a depth exceeding 6000 feet.

The first well was drilled with rotary tools to a depth of 4380', where 8¼" casing was cemented and the hole carried to a depth of 6,625 feet with standard tools.

The second well was drilled to a depth of 4630 feet with rotary tools where 8¼" casing was cemented and the hole carried to a depth of 6,022 feet with standard tools.

In all our experience with this derrick we have never had a minute's trouble with any part of it. We inspected the derrick several times during the drilling of the first well, but we found that it was entirely unnecessary. We did not have to inspect the derrick at all while drilling the second well.

We find this derrick to be entirely satisfactory in every detail, and we cannot praise it too highly.

Yours very truly,

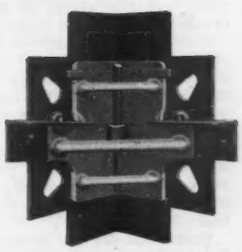
TIPPETT & BOND DRILLING CO.

By Ed Tippett

EJ/P

The *boltless* Clamp Joints of the BRADEN Derrick grip legs and girts securely. There are no bolt holes to allow play—cumulating to the top of the derrick. When the derrick is strung up with the turnbuckles there is no racking, no loosening of parts. This derrick stays tight as a fiddle—flexible—safe—a derrick without a weakness.

All designs and capacity ratings in accordance with A.P.I. specifications.



The patented Braden *Clamp Joint* saves at least a day in time required for erection. Leg members have full end to end bearing.

BRADEN STEEL CORPORATION
TULSA, OKLA.
Also manufacturers of Braden Sectional Steel Buildings

BRADEN
CLAMP-JOINT DERRICK

safety and everything must be well anchored in the cellar.

"The oil, which is really a naphtha, is of 72 degree A.P.I. gravity and many automobiles in the field use it for fuel. It is pure white and smells rather like kerosene, with a trace of sulphur. It is estimated that over 350,000,000 feet of natural gas are being burned daily at flares throughout the field because no satisfactory disposition of it has been found. This is a most inefficient manner of producing oil and represents a terrific loss of natural pressure. The oil, which comes from the wells in the form of vapor, is put through separators and scrubbing plants and then the gas is turned out into flares and burned."

The productive limestone is described as the Madison formation and is full of vugs and cavities in which the oil and gas has accumulated. Capping the lime are layers of black Fernie shales and above the shales comes the Kootenay formation — shales and sandstones and coal seams.

Next above the Kootenay series is the Blairmore-Dakota formation with Benton shales on top and showing as outcrops on the surface in various parts of Turner Valley.

It is reported that these formations have been steeply tilted in some portions of the field and have steep dips which, together with the hardness of the rocks making up the various strata, causes the drill to deflect from the vertical very sharply and crooked holes have been the rule rather than the exception in this field and before the diamond drill can be used satisfactorily it is necessary to straighten the hole and a very detailed and complete description of the method followed in doing this is given in an article published on page 153 of The Oil and Gas Journal in the issue of August 22.

This article was prepared by Robert T. Banks of Spokane, Wash., and gives additional information regarding the work in Turner Valley to that quoted from the report of L. H. Harris.

In as much as various areas in Canada are just at this time receiving considerable attention these practices are of special interest and as many other fields are being drilled into high pressure oil and gas zones there is possible food for thought in some of the methods used there and it is hoped later to follow this article with others of like nature dealing further with this type of problem.

STRAIGHT HOLES ARE MADE POSSIBLE—SUMAN

(Continued from Page 57)

which will permit this division to hold its principal meeting of the year at some point such as Tulsa, Dallas, or Los Angeles, where attendance could be secured which would be worthy of the time given by the authors to the papers.

Suggests Change of Name

There is quite a feeling in the general committee of this division that instead of being called the "Division of Development and Production Engineering," that it should be called simply, "Division of Production." We believe we can secure the co-operation of more practical operators who shy off from the word "engineer," if change of name could be authorized.

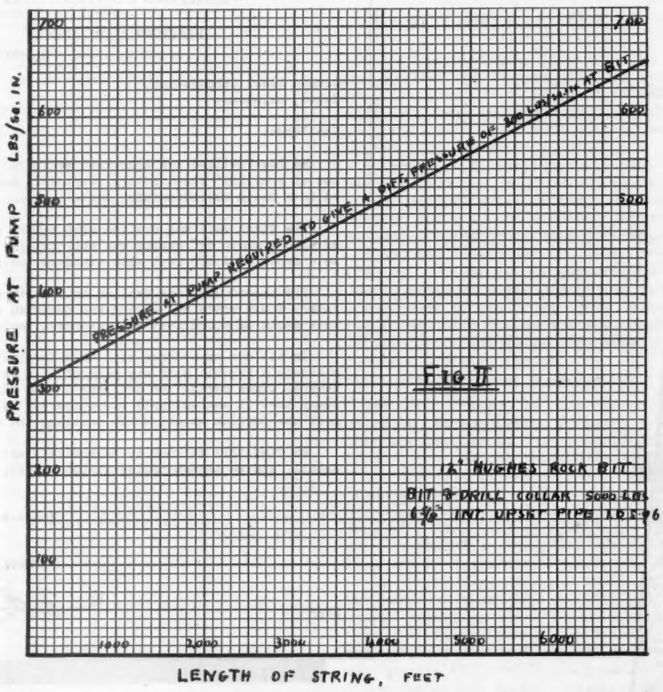
Operations for the development of oil fields in foreign oil countries are assuming such large proportions that we believe this division should adopt means to keep abreast of petroleum engineering development in these foreign fields. It so happens that a large group of American corporations engaged in foreign operations have their headquarters in New York or in the East. We believe that the eastern division should keep abreast of the development of the science in these various foreign fields and should be prepared to present papers at our annual meetings which will give the trend of this development.

It is quite apparent to many people active in the oil business that the trend of thought at present is rapidly crystallizing in favor of pool operations and unit development to the end of securing maximum economic yield at the lowest possible cost. The producers within the United States will be forced into this position within the next few years by the development of large reserves of foreign production most all of which is being developed on the unit plan at an extremely low cost per barrel. As this program begins to receive momentum within the United States the petroleum engineering profession will be called upon more and more to guide the industry along sound engineering principles in the development of these reserves or resources. It is my hope that the basic principles covering this type of development can be laid down through this division and be made available to the industry at any time they may be needed.

OFFERS NEW THEORY FOR STRAIGHT HOLE

(Continued from Page 57)

a string of drill pipe, they are certainly detrimental in the upper end. The dead weight loads for instance on a 5,000-foot string of 6-inch pipe may be increased by more than 30 per cent by the mud fluid pressure put up by the pump. Increasing depths will probably direct efforts to decreasing the additional tension in the pipe joints due to the fluid pressure and enable greater depths to be attained without increasing the total load on the joints but at the same time maintaining the straight hole drilling effect of high differential fluid pressures at the bottom.



OKLAHOMA REFINERS ADVANCE NEUTRALS

(Continued from Page 52)

62 437 grade was usually being quoted the same as the regular grade.

The higher gravities were in a better position but cannot be considered strong. Several refiners will continue to ship on export orders throughout December and these companies will not be a factor in the spot market. One export company placed an order with an Oklahoma refiner for an additional 1,000,000 gallons of 64-66, 375 endpoint gasoline. This order was for immediate delivery at a price reported to have been 7¾ cents basis North Texas. This purchase was made by the company affiliated with the Petroleum Export Association. At least one independent export buyer is still making inquiries for the high gravity grades and is reported to have placed a small quantity of business during the past week outside of Group 3. The prices paid were under those of the export association.

Fuel Oil

The wide spread in prices applies to all grades of fuel oils. Although a gravity scale is still a basis for most fuel transactions, cold test and viscosity in the Oklahoma market have become more and more important. There were several sales of fuel oil under 16 gravity made last week at 70 and 75 cents and at the same time other grades as high as 22 gravity sold as low as 65 cents.

Zero cold test fuel oils are at a premium regardless of gravity. The higher gravity grades of low cold test were practically unobtainable. One refiner sold several cars of 24-26 fuel for 90 cents and is reported to have advanced his price to $1. Another sale of 22 gravity fuel oil at 85 cents was reported.

There is little demand outside the state for fuel oils running from 40 to 60 cold test. Fortunately for the general market the quantity of this high cold test material is small. Most refiners have the cracking equipment to lower the cold test of their fuel oil and during the winter months very little is offered for shipment to the northern states.

The outlook for the fuel oil market over the balance of the year is favorable. One of the largest refinery sellers states that his output is sold up for December. Another reports that he has been offered present prices for delivery over the first 15 days of the new month.

Nothing new has developed in the railroad contracts now pending. As explained in these columns last week refiners expect to secure a more favorable base price in their contracts for next year with 60 per cent of any advance in the price of crude oil.

Natural Gasoline

The November natural gasoline market was brought to a close Saturday with little change in prices over those prevailing the middle of the month. The market continued steady on Monday and Tuesday and it is believed that this trend will continue over the month. The grade AA is already fairly well contracted for December. The Grade A output is small and very little will be offered on the spot market.

Most of the spot trading will be in Grade BB. Due to the colder weather the output of this grade has increased and it has become the most active grade in spot sales. Some of the Grade AA buyers are shifting to the Grade BB both because of the lower price and the higher gravity.

Eastern refiners continue to buy although not in large quantities. In these eastern purchases freight rates have become an important factor. There are some obvious inequalities in rates for these long hauls and it is reflected in the market. For instance, with practically the same distances involved, some Oklahoma points take a 72-cent rate to Bayonne, N. J., while others take a 78-cent rate. This difference of 6 cents a hundred amounts to a little less than one-half cent a gallon. The manufacturers with the lower rate have an advantage in these long hauls and they are getting all the eastern business. A few manufacturers which have the low freight rate are not in position to sell to eastern refiners due to a shortage of tank cars.

Kerosene and Distillates

Kerosene prices were lowered one-eighth to one-fourth cent during the past week by several refiners. Other refiners did not change their prices so that the wide spread in quotation obtains as in the case of gasoline and fuel oil. The 41-43 water white grade was selling at 4¼ to 4¾ cents. Small export orders were placed in North Texas at 4 cents.

It is not believed that the 41-43 water white grade will go lower than 4 cents in Oklahoma. There is a wide margin for the exporters at present prices and additional buying may materialize. The domestic demand will also improve after the first of the year.

Opinions are divided among Oklahoma refiners in regard to the distillate situation. Several refiners who early last week were quoting low prices were flooded with orders and they have advanced their prices so that 3⅝ cents was low for the regular grades the first of the week with most of the sales being made at 3¾ to 4 cents for the 36-38 and the 38-40 grades. The low cold test grades were in greatest demand.

It is expected that the extremely cold weather in the Middle West will be reflected in the refinery demand and several sellers are predicting a general advance before the middle of the month.

Lubricants and Wax

Outside of the neutral oil advances previously mentioned there were no changes in Oklahoma lubricants. The bright stock demand is steady and there are no distress accumulations of steam refined stocks. The wax market continues inactive. The general price level is unchanged although most of the inquiries are coming from buyers who are offering lower prices.

OPERATE GASOLINE LINE EARLY IN 1930

(Continued from Page 56)

line systems, or involving the construction of new lines, would have a vital bearing upon the entire distributing end of the business.

Lower Freight Rates

Another angle which is receiving close attention in the trade here is the possible effect of Standard of New Jersey's departure upon railroad freight rates. With just the Tuscarora line in operation as a gasoline carrier, the effect of this competition upon the railroads will be localized. Extension of the pipe line transportation of motor fuel, however, would have a material bearing upon railroad freight revenues, and the possibility of such a development might possibly tend to bring about action by the railroads looking to a downward revision in existing tank car schedules to meet the competition afforded by pipe lines.

Another branch of the industry vitally interested in further development of pipe line transportation of gasoline is that made up of the principal tank car building and renting companies. Any general trend toward utilization of pipe lines for moving gasoline would naturally be immediately reflected in the operations of the tank car companies, and while tank cars would still be required for moving lubricating oil, kerosene, gas and fuel oils, etc., the cream of the business would be skimmed were the gasoline traffic to be lost to any considerable degree.

Standard Oil Co. of New Jersey has

proceeded carefully in its plans for pipe line transportation of gasoline, and has been considering the present step in the developing of its distributing system for the past year or more. Until the line is in successful operation, it is not expected that the company will be in position to make public any of the specific details of its operations. The New Jersey company has been one jump ahead of the rest of the industry in this particular respect, but apparently seems to feel that there is nothing out of the ordinary in its recourse to the Tuscarora line as a gasoline carrier and has no comment to offer regarding the numerous reports in circulation in the trade here as to its plans for invading this or that market by the extension of its pipe line shipping activities.

This most recent development in pipe line utilization, however, is generally regarded as more significant even than the action of the National Transit Co. earlier in the year in reversing the flow of its line to enable it to deliver crude oil inland from the coast to the Pittsburgh and Franklin refining areas in Pennsylvania.

Some interests in the petroleum industry have, for the past year or more, been prone to count the pipe lines out of the picture entirely, and saw no future for them after a few years more save as possible links in natural gas systems. The successful operation of the Tuscarora line as a carrier of gasoline, however, will open up an entirely new vista for most of the pipe line companies.

NEED FOR CONTINUED PRORATION IN OKLAHOMA

(Continued from Page 56)

area, and all pools in the Greater Seminole area.

To accomplish the degree of curtailment necessary to maintain an approximate balance between supply and demand during said first three months of 1930, we suggest the following schedule of proration:

SUGGESTED PRORATION PERCENTAGES

Oklahoma City:	Per cent
January	40
February	40
March	50
East Earlsboro:	
January	40
February	40
March	50
Seminole, and others:	
January	20
February	20
March	20

PRORATION PERCENTAGES APPLIED

Potential daily average production—Jan.:	Barrels
Oklahoma City	140,000
East Earlsboro	80,000
Seminole, et al	349,500
Rest of State	230,000
Total	799,500
Estimated production under proration—Jan.:	
Oklahoma City	84,000
East Earlsboro	48,000
Seminole et al	279,600
Rest of State	230,000
Total	641,600
Potential daily average production—Feb.:	
Oklahoma City	200,000
East Earlsboro	80,000
Seminole, et al	340,000
Rest of State	230,000
Total	850,000
Estimated production under proration—Feb.:	
Oklahoma City	120,000
East Earlsboro	48,000
Seminole, et al	272,000
Rest of State	230,000
Total	670,000
Potential daily average production—Mch.:	
Oklahoma City	300,000
East Earlsboro	70,000
Seminole, et al	327,000
Rest of State	225,000
Total	922,000
Estimated production under proration—Mch.:	
Oklahoma City	150,000
East Earlsboro	35,000
Seminole, et al	261,600
Rest of State	225,000
Total	671,600

Upon examination of the provisions of the order of the Corporation Commission now in effect with reference to the delay which each new well is required to take before it is permitted to produce, we are convinced that there should be a modification in this regard in any order adopted by the Commission to apply after January 1 next because of the pyramiding of shut-in time which would result from a continuation of the present plan. We, therefore, recommend that a stated number of days of shut-in time be fixed to apply to all wells that may be drilling on January 1, 1930, or which may be commenced prior to March 31, 1930, according to a schedule as follows:

	No. of days of cement to set	No. of days of open flow for test	Days shut-down	Total
Oklahoma City	7	1	57	65
East Earlsboro	7	1	41	49
Seminole, et al	7	1	16	24

These committees jointly suggest that a meeting of all the operators interested in the above mentioned pools be called for 10:30 a.m., Thursday, December 12, 1929, in the assembly room in the Exchange National Bank Building, Tulsa, and that this suggested plan be presented to said meeting for consideration and if approved that the same be presented to the Corporation Commission of Oklahoma as the basis for a conservation order to be made by that body prior to January 1, 1930, to take effect on that date.

Respectfully submitted,
C. C. HERNDON,
Chairman of Association Committee.
W. C. FRANKLIN,
Chairman of Operators Committee.

DEVELOPMENTS IN COMMERCIAL CRACKING

(Continued from Page 62)

its entrance, and conversely some of the stock remains in the digester indefinitely.

Commercial Plant

A plant which embodies the principles discussed is illustrated. This plant includes a furnace (A) of ample heating surface, in which the radiant heat is well distributed over a large number of tubes and in which high velocities are maintained. The evaporator (B) is of small cross section, with provision for maintaining the liquid at a low level. This liquid has a commercial tar content of 35 per cent to 40 per cent, and is withdrawn to a flash still (D) at low pressure where it is distilled by its residual heat. The commercial tar, of about 200 seconds Saybolt at 130° F. is withdrawn from this still, and the vapors are condensed in heat exchanger (E). The condensate from this exchanger passes to mixing chamber (F), to which the fresh feed is admitted. The mixed stocks from chamber (E) are pumped through the exchanger to this system. The vapors from the evaporator pass to a fractionating tower (C), from which naphtha is drawn overhead and cycle stock from the bottom The cycle stock and fresh feed are pumped to the furnace (A).

A plant of this design will operate successfully on heavy gas oil or topped crude with practically no formation of coke, and will produce a tar with a sediment approximately 0.3 per cent to 0.5 per cent. The yield from a plant of this kind will be contingent upon the degree to which the tar is reduced by distillation. The quality of tar withdrawn will be dictated, as a rule, by the viscosity required for blending and marketing purposes.

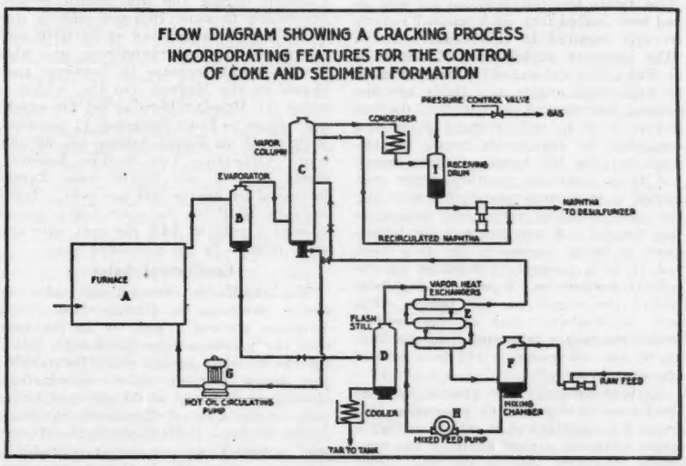


Figure 6.

Desulpherizer

In most cracking plants, the naphtha is condensed in the presence of the gases produced in the process. Naphtha and gas are, therefore, in equilibrium. The naphtha is saturated with fixed gases, including hydrogen sulphide, and the gas with gasoline fractions, the saturation depending on the pressure and temperature under which the two products are separated.

It was found that a substantial amount of the fixed gases could be eliminated with a relatively small loss of gasoline, if separation could be effected at pressures in excess of about 150 pounds per square inch. Separation in two steps, for instance, the first at 250 pounds, the second at 150 pounds, involves lower losses of gasoline than separation in a single step at the lower pressure.

The naphtha withdrawn at the lower pressure is still a very "wild" product. If released to atmospheric pressure, a considerable amount of rich gas is given off, which must be treated in a compression or absorption plant for the recovery of the gasoline fractions. With gases high in hydrogen sulphide, it is practically necessary to subject them first to a preliminary treatment for removal of this constituent. Both the naphtha and recovered gasoline still contain appreciable amounts of undesirable fractions and should, therefore, be subjected to a final rectifying step to complete the process.

A more economical solution to the problem was finally developed, involving high pressure rectification of the naphtha before the final release of pressure. A very sharp fractionation is thereby obtained between desirable and undesirable constituents. The gas is practically free of gasoline fractions; the naphtha can be processed to any desirable vapor pressure, and is substantially free of hydrogen sulphide and other fixed gases—an important advantage in the subsequent treating and rerunning operations.

The arrangement of the equipment is illustrated. The first step in the process

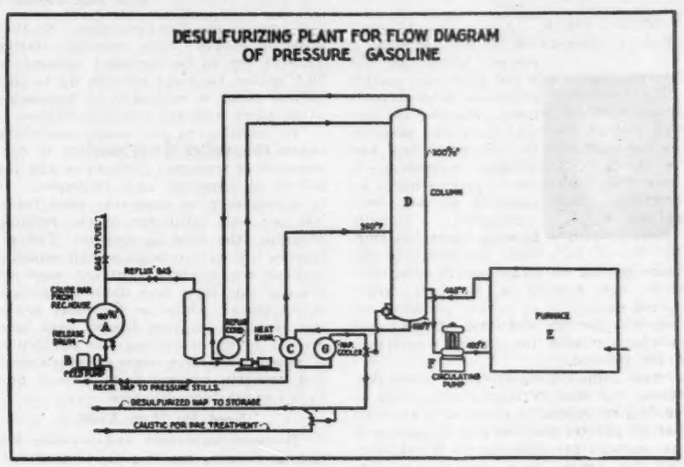


Figure 7.

begins with the separation of the gas and the liquid in the pressure still receivers. This separation of the gas from the naphtha aids in the fractional separation that takes place in the secondary receiver (A), which is held at a gauge pressure of 140 pounds to 160 pounds. The gas discharged at this point is relatively dry, and the loss of gasoline fractions small. The separated naphtha is picked up at this point by a pump shown at (B), and discharged through a heat exchanger (C) into a bubble plate tower (D) under a pressure of about 300 pounds. The stock in the bottom of the tower is maintained at about 460° F. by circulation through a furnace (E) by means of a pump. The rectified naphtha passes from the bottom of the tower through the heat exchanger and a cooler (G). Reflux is produced by water cooling, and is pumped to the top of the tower which is held at about 110° F. The exact temperature will, of course, depend upon the vapor pressure of the naphtha and the degree of stripping desired.

The receiver (A) is of quite large capacity, and so acts as a surge chamber in which minor fluctuations in the rate of naphtha production are absorbed. The discharge of a relatively large volume of gas at this point relieves the demand on the tower, and makes it possible to operate at moderate pressures while using an ordinary water supply for reflux condensing. The principles involved in this process will be readily understood. This process is practical, and has been entirely successful in operation. The rectified naphtha is practically free from hydrogen sulphide which is discharged with the gases, and the caustic required for pre-treatment has been reduced to a minimum.

DEATH OF J. B. SCHERMERHORN

James B. Schermerhorn, widely known oil operator, died Saturday, November 30, in a hospital at Rochester, Minn. Mr. Schermerhorn's home was in Minneapolis, Minn., but his principal operating offices were in Tulsa. Deceased was 60 years old. He had been operating in the Oklahoma fields, particularly in the Ardmore district, for years. He was a director of the Northwestern National Bank in Minneapolis; president of J. B. Schermerhorn, Inc., and executive head of the Schermerhorn-Ardmore Co. and the Schermerhorn-Young Co., all oil companies. Mrs. Schermerhorn and two children survive him.

Russia Needs More Oil for Home Use

Growth of Consumption Following Increase in Cars, Trucks and Tractors Reduces Stocks and May Affect Exports

By A. E. Mockler
New York Bureau, The Oil and Gas Journal

NEW YORK, Nov. 30.—Although Russian competition is still proving a potent factor in the world petroleum market situation, recent reports from Russia indicate that the Soviet program for oil producing and refining expansion is not progressing as smoothly as had been anticipated. Rapidly growing home consumption, incidental to the more general use of automobiles and tractors, has created a situation where larger quantities of refined products are required for the domestic trade, and stocks available for export correspondingly reduced.

The Amtorg Trading Corp., which conducts the Soviet's buying operations in the United States, is reported in the market for 50,000 tractors and thousands of automobiles for shipment to Russia during the coming year, and the gasoline and lubricating oil consumption of these machines will be a potent factor in still further restricting Russian exports, unless the Soviet should succeed in rapidly developing new sources of crude supply and in further stimulating refinery operations.

The expansion program of the Soviet government contemplates for the oil industry production of 16,100,000 tons of crude petroleum and 13,400,000 tons of refined products by the close of the 1929-30 fiscal year which ends September 30, next. Plans for export expansion by the Soviet oil trusts were based on this schedule. Current reports seeping out of Russia, however, indicate that production of both crude and refined may be expected to fall materially under these anticipated totals.

While refinery construction is being speeded by the purchase of modern cracking units and other apparatus in the United States, the development of increased refining capacity, it is understood, has not progressed according to schedule, numerous delays being encountered.

Crude production, likewise, is reported to be falling under expected totals. Many wells in the famous Baku Field are reported to have been exhausted by the heavy withdrawals of the past few years, forcing the Soviet to resort to an extensive program of field development work to keep their refineries supplied.

Increased Consumption

Extracts from a report on the Soviet oil industry by P. Shokh, the Soviet oil expert, recently received in this country, say in part: "The year just past (referring to the 1928-29 fiscal year) was a period of considerably strained work in the oil industry, both in the construction and production branches. In consequence of the bad underestimate of the needs of the domestic market for light products, it was necessary to increase the first program of output and refining twice during the year; and still there is a shortage of kerosene, petrol and other popular oils. This event, entirely unknown in the experience of the past years, is closely connected with the increased use of tractors and motor cars, stoves in towns and villages, and kerosene for lighting purposes.

"Under the influence of industrialization, the demand of the domestic oil market is not only growing as regards quantity, but is undergoing changes as regards quality, by increasing the importance of such products as petrol, kerosene and lubricating oils. This process is making an adverse impression on the second year of the five-year plan. So that although output and refining during 1929-30 are to be increased (output to 16.1 million tons and refining up to 13.4 million tons) it will still be impossible to do away with the strained position.

"In addition to the usual productive causes this position will continue in consequence of transport difficulties and the failure to complete new refineries. It is unnecessary to stress the need for a 100 per cent fulfilment of the refining program; the need is obvious. The refineries will have to work at full capacity without any reserves whatever, since on the one side there is a distinct shortage of equipment, whilst on the other is the fact that the program figures have been arrived at by estimating the production of new installations, some of which were just recently ordered from abroad and have not yet been delivered.

Need for More Yield

"However important and pressing the task of refining may be, the task of survey is just as important and just as pressing. The rate of surveys have obviously frustrated our aim at a rapid replacement of our oil resources. Inasmuch as the five-year plan provides that by 1932-33 the yield from new fields must represent more than one-third of the total yield, it is absolutely vital to hurry."

The foregoing report from Soviet sources makes no direct mention of well exhaustion in any of the Russian fields, but private advices which have come out of Russia indicate that production in the older fields has not held up as well as had been looked for. Independent reports recently received in this country state: "The intensive exploitation of the fields at Baku has exhausted a large number of wells, and unless new fields are discovered and worked, output must decline. Survey work in and around the districts controlled by the Soviet trusts has always been in the hands of these trusts, but their financial position never permitted a systematic search for new oil; they are therefore very much behind in this respect. A new concern or department is being organized for this work and if it is properly subsidized by the central authorities, it will undoubtedly relieve the strain on the trusts. The fear is, however, that as the central authorities never take any risk, the finding of new oil resources will be a painful and slow process."

Notwithstanding the evident partial breakdown in the Soviet's expansion program, its campaign of development for a larger share of export business has continued unabated during the past year. According to the annual report of Sokolnikoff, chief of the Soviet Naphtha Syndicate, capital outlays in this direction during the fiscal year 1928-29, which ended September 30, last, totaled 22,000,000 roubles. The Touapse depot with a storage capacity for 150,000 tons of refined products, has been completed and another new depot is under construction at Batoum. Two large ocean-going tankers have been added to the syndicate's fleet during the year. Huge extensions were made during the year in foreign depots, notably in Germany and England.

Gain in Exports

Russia's importance as a world petroleum factor is illustrated by the heavy gain in exports of Russian petroleum products during the first nine months of the 1928-29 fiscal year of the Soviet oil industry. In the face of material reduction of consumption in Europe and a war against ROP (Russian oil products) in England, which continued up to March of this year, Soviet oil exports for the nine months ended June 30, 1929 showed a gain of more than 25 per cent over the comparable period in the previous fiscal year. The ending of the British fight on ROP was achieved through an agreement arrived at between the Soviet and the so-called "Anglo-American" combine. Details of Soviet exports follow:

Thousands of metric tons

Product—	First nine months fiscal year 1926-27	1927-28	1928-29
Kerosene	323.4	498.8	540.0
Gasoline and ligroine	384.4	551.0	730.0
Lubricating oils	113.6	130.3	142.6
Heavy solar oil	11.2	32.7	46.2
Gas oil	99.3	146.2	169.5
Mazout and Diesel oil	410.0	516.2	768.0
Crude petroleum	76.6	106.0	113.2
Totals	1,418.5	1,981.2	2,509.5

Operations of ROP

The ROP in Great Britain was the heaviest buyer of Soviet petroleum products. ROP not only sells on commission for the Soviet but also purchases for its own account. The ROP is a factor not only in England but in other British possessions as well, the following table, compiled by the Division of Regional Information of the Department of Commerce, showing ROP sales from October, 1928, to June, 1929, both inclusive:

Thousands of metric tons

	England		India		Egypt		South Africa	
	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29
Gasoline and ligroine	84.5	196.3	....	....	5.8	15.7	5.3	7.8
Kerosene	142.6	227.9	126.7	140.8	109.5	79.6	....	....
Lubricating oil	22.0	36.2	....	....	....	....	....	0.2
Fuel oil	37.0	44.9	1.0	0.5	....	....	....	21.9
Total	286.1	505.3	127.7	141.3	115.3	95.3	5.3	29.9

The heavy increase in exports to England during the nine-month period, amounting to some 76.5 per cent, is due to the agreement arrived at by ROP and the Anglo-American syndicate, and also by the heavy increase in kerosene purchases by the Medway Oil Co., which is using the Russian burning oil for cracking. Sales to India increased 11 per cent, with those to Egypt falling off 30 per cent. Offsetting this decline, however, direct imports into Egypt from Russia increased by nearly 200 per cent. Total sales by ROP for the nine-month period showed a gain of 44.5 per cent over the same months in the preceding year.

Continental Sales

Naphtha-Russe, controlling sales of Soviet products in France, Spain and Belgium, showed a gain of 30 per cent over the previous year in its sales totals for the 9-month period, while Derunapht, the Soviet German sales organization, showed an increase of 60 per cent in its sales to the Central European countries.

The Soviet's Italian syndicate, "Petrolea," a Soviet concern operating under a concession from the Italian government, showed a loss in sales, dropping from 382,400 metric tons in the first nine months of the 1927-28 fiscal year to 359.1 tons this year.

The Constantinople office of the Soviet syndicate in the nine-month period this year marketed 212,500 metric tons, against 161,400 metric tons in the comparable period last month.

The Soviet this year has also increased its sales in Buenos Aires from 2,300 tons of all products in the first nine months of 1927-28, to 12,600 tons in the comparable period of the last fiscal year.

In British Market

With the settlement of the protracted price war which the Soviet Naphtha Syndicate had been waging wtih British companies in Great Britain, the British market has become much more attractive to the Soviet exporters. Plans for the 1929-30 fiscal year of the Syndicate call for a material expansion in operations in England. Depots in the south of England are to be enlarged and a "special attack" is to be made in East Anglia. Special attention also is to be paid to increasing the number of pumps and stations during the winter months, so that these additional distributing outlets may become fully active in the spring. The report of Sokolnikoff also mentions the difficulties which have been encountered in increasing production, saying: "In spite of the favorable results of the year, it must be admitted that we have in the oil industry an obvious and growing disproportion between the demand for products and the available productive possibilities."

Competition in France

The Naphtha Syndicate's report discloses that intensive selling efforts are to be made in France. This is of direct interest to the American oil industry, which does a large volume of business in refined products in that country. A concentrated effort is being made by the Soviet authorities, the report states, for the removal of the existing ban on direct imports into France by the Naphtha Syndicate. This fight is based on the refusal of the French authorities to grant import licenses to the Syndicate. No particulars are given as to the methods of securing the wanted recognition from France, but it is intimated that the French government has been approached on the subject and that a campaign among leading politicians in that country may yield the required results. However, as France is now engaged in an effort to build up her home refining industry and is making strenuous efforts to develop crude production abroad, the success of the Soviet campaign in this direction is problematical. Certainly American oil companies operating in France have found it necessary to live up to the letter of the stringent regulations which that company has imposed upon oil importation and distributing.

Seeking New Sources

In an attempt to stimulate new sources of crude production in Russia, the Soviet government has appropriated 1,000,000 roubles for development work in the new Ural Mountain oil fields. This money will be expended in field research in the area during the fiscal year 1929-30. Two geological parties have been employed for work in the region of Chusovskie Gorodki, under instructions to drill 14 test wells and to survey and drill on an area of 7,000 meters.

Extensive development is also planned in the Okha fields on the Island of Sakhalin. The first well drilled in in this field struck oil at a depth of 101 meters. The Sakhalin fields, it is reported, are expected to yield huge oil deposits.

All of the available data on the Soviet petroleum industry indicates that the Soviet petroleum industry is determined to "go it alone" in its oil development work and that co-operative action with other leading oil producing and refining companies is not contemplated. The Soviet, because of its apparent isolation from the remainder of the world, seems determined to develop its home and export oil trade without regard to the activities of other oil countries. Experiences of the past few years have shown the Soviet ready and willing to cut prices

as part of expansion operations, as the protracted price war in Great Britain, during which gasoline and other products sold at prices under the world parity, clearly disclosed.

To Hold Foreign Markets

Notwithstanding the reported shortage of light refined products for domestic consumption, it is expected that the Soviet oil interests will continue exporting at least on the present basis, and that every effort is to be made to hold foreign markets already developed until the production schedules in Russia catch up with consumptive requirements. Recent developments in Russia, however, indicate that further expansion of Russian export marketing operations, on a large scale, is not likely to develop in the near future. Thus, it is felt, that while American oil exporting companies will still encounter keen competition from Russia in many world markets, the marketing activities of the latter will not expand nearly as quickly or extensively as had been feared in some quarters.

Owing to the hostility of the powerful Royal Dutch-Shell interests toward the Soviet oil industry, due to the action of the Soviet in confiscating important Anglo-Dutch oil properties in the process of its nationalization campaign, American oil interests are in many instances saved the task of direct competition with Soviet oil on a price basis. In this respect, at least, world unity (with the exception of Russia) appears assured, and Royal Dutch-Shell serves partially as a buffer between the Soviet oil industry and that of the United States.

Russian interests are reported as still active in the United States in the purchasing of cracking equipment and other modern refinery supplies and, in addition, Soviet interests have hired a number of American oil technicians to aid them in developing their production and refining facilities. Thus, when the Soviet five-year expansion program is finally completed, the Soviet oil industry will be in a position to offer keen competition, due to the fact that a large part of its industry will be equipped with the most modern types of producing and refining apparatus. This, combined with the cheap labor obtainable in Russia, is a factor which leaders in the American oil export trade are not losing sight of in planning their future operations.

COMMON SENSE IN THE OIL INDUSTRY

(Continued from Page 55)

day production of that district of less than 700,000 tons per annum support that old-time expenditure? Today we see that gradually the producers there are trying to unite in bigger units, but never can the waste of the past be made good, as it is more than doubtful whether the production can ever again become what it was in 1909.

Now to return to our "Moutons" as the French say. What can we do to avoid such Mexican and Galician disasters here? Of course they can never be of that magnitude here with so many oil fields scattered in a country to be compared only with a united Europe, and not land-locked as old Galicia is.

What Pennsylvania Lost

Still, has it been a blessing to more than a few that Pennsylvania sold its large quantities of the world's best oil before there was the demand for its super qualities? It took time—and a long time—to create that demand for its cylinder stocks. If it could have supplied at fair prices all demands (and it could not by a long way) all the improved and sometimes costly machinery to make as good oil from other crudes would not have come about so rapidly, the price would not have varied from $1.20 to $6.25 per barrel and good Pennsylvania oil stock capable of producing highly valuable products would not have gone into fuel oil.

Please do not misunderstand this as a criticism on the past. If it were it would come under the heading: "Judging events in the light of past experiences." But I only quote it in order that we may now benefit by this experience. In other words: "Preserve your wealth for the time when it will be wanted, and do not waste it when it runs too freely." Too many of us in the past, and even a great many today, think the oil supplies inexhaustible and we pay far too little attention to wasteful exploitation (apart from producing too much), forgetting that new fields in the states may still be "discovered" but they can never be "created." Nature put them there in a limited number and it is almost childish to state that the more that are discovered the fewer that are left to the fate of discovery. Still — happy-go-lucky — so many people conveniently forget this axiom, whilst ready to "howl in the chorus," no doubt, if the day of reckoning should come in their lifetime, or to turn—unknown to those living then—in their coffins should it come after. But although too many democracies are ruled with the idea "Apres Nous Le Deluge," we oil men, representing large companies which will live—if not forever— certainly longer than such selfish demagogues, have to keep the possible nearness of such events well in mind.

Duty to Consumers

Our duty is not only to our shareholders, it is also the protection of the consumers, and I must raise my voice of warning that it is a bad day when the consumer is made to believe in everlasting low prices, and then later by a temporary scarcity has to face higher prices. There is no need for this event. Wise conservation, which is "practical conservation," is wanted by shareholder, producer and the consuming public alike. Do not be led away by the noise of publications about trusts; some publications can only exist by making cheap noises, if we do what we honestly believe is our duty to the public, nothing ought to stop us from doing that duty. It is a happy man who is never reproached by his conscience.

There are wise men of distinction who have been saying, publishing more than once, "are the United States going on producing all they can—more than they can consume—with the result that they are exporting today at a low price what they are likely to be importing later on at a higher price? Are they going on overproducing today when they may be overconsuming in a few years?" The point has not been put which is in many minds outside the states: "Are we (the public outside the United States) going to rely on supplies from the states when these may be less at some approaching time, seeing that no thought is given to conservation? Must we (non-Americans) not strain every effort, however costly, to protect ourselves for our future consuming needs seeing that continuation of exports from America is simply looked upon as temporary dumping of excess production?"

Advice to Americans

That, of late years, American producers have taken an interest, and more than a passing one, in foreign producing fields is really the outcome of the sound view that the world should not be entirely dependent on one country of supply. But then, why not go a step further on this international way and preserve the supply of your own country for the time when you do not want to export it, but can realize for it the price which it would cost others to bring it to its destination in the states?

But all this is not "the goods" for the delivery of which we have come here today, namely, the question: "What is to be done? What is the best thing to do for the industry as a whole?"

OIL SHOW IN 1931 MAY BE HELD IN MAY

(Continued from Page 54)

next 10 days the matter of the proposed $500,000 bond issue for the Tulsa Free Fair and the International Petroleum Exposition. If the bond issue passes additional buildings and facilities will be provided at the exposition grounds. In the event the bond issue fails at this time the exposition management will arrange to take care adequately of all exhibits of the natural gas industry.

Directors of the International Petroleum Exposition will hold a meeting in Tulsa on December 14 to consider the matters discussed at the meeting here today.

In case the plans are approved by the directors, a formal invitation will be issued to the American Gas Association to hold the annual convention of the Natural G[illegible] Department, or the Southwest division of that department, in Tulsa each year in the spring in connection with the annual International Petroleum Exposition. It is the plan to hold the exposition every year in Tulsa following the lapse of 18 months between October, 1930, and May, 1932.

Late Fields

(Continued from Page 64)

side of West Columbia has revived interest in that area with its completion Monday flowing initially at an estimated rate of 2,000 bbls. a day of oil, with 45 per cent sediment and water. The production is from sand at a total depth of 2,823 feet and the oil is 22.8 gravity, temperature 86 degrees.

The Gulf Production Co. has abandoned its No. 3 B. Hogg at West Columbia at a total depth of approximately 4,060 feet. Two good wells have been added at Refugio in Independent Oil & Gas Co.'s No. 1 Claude Heard and the Houston-Gulf Gas Co.'s No. 2 Morgan Shelly. The former was completed flowing at the rate of 312 bbls. of pipe line oil at 3,678 feet and the latter 100 bbls. of pipe line oil at 3,659 feet.

KANSAS

Slick, Pryor & Lockhart's No. 1 Peasel, NW cor. Section 33-31-1w, Sumner County, has been cleaned out to the bottom at 3,675 feet, and started flowing in the slush pit. It was estimated it made 300 bbls. in 17 hours. Tanks will be erected before the wildcat test is drilled deeper in the pay, which some believes to be the chat. The oil tests 40 gravity.

Slick, Pryor & Lockhart's No. 2 Bright, NW cor. Section 1-26-2w, Sedgwick County, in the Valley Center Pool, has the Simpson pay at 3,358-61 feet. It has a hole full of oil and will be swabbed to test its production.

Shell Petroleum Corp.'s No. 1 Southwestern College, SW cor. SE SW Section 2-27-1w, Sedgwick County, had a small showing of oil at 1,400 feet. While this small show will not make a commercial well it indicates the test may be running high on structure. It offsets the Plains Oil Co.'s No. 1 Curry, in Section 2-27-1w, which was the discovery well in this area.

OKLAHOMA

Oklahoma City Pool made 57,348 bbls. from the class "A" wells on the gauge of December 3, at 7 a. m.

Indian Territory Illuminating Oil Co. and others' No. 2 Watters, NW cor. NE, Section 25-11-3w, blew in making 62,000,000 feet of gas and 1,199 bbls. of oil the first 16 hours. It is producing from the lime at a total depth of 6,412 feet. Six-inch casing was landed at 6,303 feet.

Coline Oil Co.'s No. 1 Clauer, NE cor., Section 25-11-3w, will skid the rig and drill a new hole, the old total depth being 5,363 feet. The hole was lost on account of a fishing job. It is the first hole in the field to be abandoned.

Prairie Oil & Gas Co. and others' No. 1 Sudik, C NE NE, Section 8-10-2w, Cleveland County, was drilling in lime at 7,528 feet, December 3. It is the deepest drilling test in the area west of the Seminole fields.

Homaokla Oil Co.'s No. 1 Newsome, C SE NE NE, Section 16-5-5, McClain County, flowed 290 bbls. on the gauge of December 3. The pay was found in Viola lime at 3,582-97 feet. This wildcat well extends the producing area about 8 miles southwest of the old Asher Field.

Skelly Oil Co. and Independent Oil & Gas Co.'s No. 1 Elrod, NE cor. SW, Section 31-19-4w, Logan County, found a hole full of oil in the Bromide pay at 5,804-25 feet. The test is shut down for tanks.

J. S. Cosden, Inc.'s No. 4 Gardner, SE cor. NW, Section 30-19-4w, flowed 94 bbls. from Bromide pay at 5,890-5,990 feet. The test was believed to have top of the Wilcox sand at 6,002 feet, where it increased its production to 174 bbls. The test was fishing at 6,002 feet on December 3.

In the new Wilcox sand pool west of the old Allen Field in Sections 13 and 14-5-7, Seminole County, seven wells made 3,899 bbls. on the gauge of December 3. The gauges by companies and leases were as follows:

Company, farm—	Bbls.
Blackwell, No. 1 Fleet	795
Blackwell, No. 3 Fleet	295
Texas, No. 1 Lewis	560
Barnsdall, No. 1 Lustey	540
Magnolia, No. 1 Reed	624
Mid-Continent, No. 2 Harjo	705
Magnolia, No. 1 Paney	380
Total	3,899

Shell Petroleum Corp.'s No. 5 Petty, NW cor. SW NE, Section 19-11-2w, swabbed 30 bbls. of oil and 1,150 bbls. of water the first 24 hours. It found the pay in lime from 6,240-6,504 feet.

Sinclair Oil & Gas Co. has announced three new locations on its School Land lease which consists of 480 acres. No. 2, NE cor. SE, Section 36-11-3w, which is a half mile south of the discovery well in the NE cor. of the same section, No. 3, SE cor. NE NE, and No. 4, NW cor. NE NE, of the same section.

RALPH ESTEP DEAD

Ralph Estep, formerly with the Standard Oil Co. of Indiana and later with the Pan American Petroleum & Transport Co., died recently in New York. He contracted an ear affection while on the Island of Aruba, Dutch West Indies, which brought on complications that were responsible for his death. Burial was in Longmont, Colo.

CAUSE OF INCREASED EXPORTS

Heavy in-season buying on the part of foreign countries and the general upward tendency in the United States foreign trade were principal factors in a 33 per cent increase in exports of petroleum and petroleum products in October over the same month of last year, according to an oral statement by John W. Frey, chief of the petroleum section of the minerals division, Department of Commerce.

SUMMARY OF STATEMENTS MADE NOVEMBER 10, 1929, RELATING TO BUSINESS OF VARIOUS PIPE LINES FOR MONTH ENDING OCTOBER 31, 1929

	Gross stocks	Runs from wells	Other receipts	Regular deliveries	Other deliveries
National Transit	719,388.96	404,122.07	876,068.64	601,799.57	599,342.29
S W Pa Pipe Line	498,919.11	94,485.54	661,964.94	332,869.58	466,594.39
Eureka Pipe Line	1,398,117.80	407,367.33	354,128.92	228,566.66	529,078.81
Buckeye P. L. (Macksburg)	400,582.44	368,647.98	58,258.98	196,645.46	215,991.27
Buckeye P. L. (Lima, etc.)	2,783,005.84	111,929.62	2,566,775.95	1,676,756.01	1,053,897.13
Buckeye P. L. (Cleveland)	48,885.71	12,971.28	54,759.93	2,185.51	73,070.47
Indiana Pipe Line	747,719.04	5,168.79	3,066,913.61	1,425,999.12	1,472,354.40
Cumberland Pipe Line	562,259.60	197,918.75	3,720.63	178,996.97	.....
Southern Pipe Line	339,742.96	.....	292,024.39	64,066.81	271,559.93
N. Y. Transit	142,410.37	32,746.64	241,241.41	292,940.39	6,291.04
Northern Pipe Line	328,077.84	.....	478,809.20	168,667.97	345,368.67
Tuscarora Oil	265,678.11	.....	.....	.....	497,275.69
Total Oct. 31	8,234,787.78	1,635,358.00	8,649,666.60	5,169,494.05	5,530,824.20
Total Sept. 30	8,240,441.52	1,411,849.25	8,206,766.88	5,086,142.47	4,894,049.80
Difference	5,653.74	223,508.75	442,899.72	83,351.58	636,774.40

INSTITUTE APPROVES UNITIZATION PLAN

(Continued from Page 53)

horsepower boilers and for high tensile pipe of 95,000 pounds.

The large attendance at this convention surprised even those who had predicted it would be a record breaker. Practically every company in the producing, refining, marketing, transportation and equipment branches of the industry is represented by its main officials, engineers, superintendents and other key men. While the main business of the convention is being conducted in the committee meetings and group sessions, possibly the greatest good being accomplished is through the interchange of views and opinions and the exchange of ideas on methods and practices. It seems that every nook and corner of this big hotel contains a group of men engaged in earnest discussion of some phase or problem of the business.

This annual convention of the American Petroleum Institute has become the grand reunion of the entire petroleum industry. Many men attend the convention chiefly to renew old friendships and to reminisce with men with whom they worked years ago. "Uncle Dave" Stewart of the Magnolia Pipe Line Co. of Dallas, said he was amply rewarded for the long cold trip when he and Arch Leonard, of the Devonian Oil Co. and numerous other concerns of Tulsa, and John Manion of the Sinclair Pipe Line Co. got together. It seems that about 30 years ago Arch was a plutocrat among oil field workers for he had a horse and buckboard, whereas Uncle Dave and Manion merely owned shoes and a desire to get out to their work in the field. Arch was given the honor of carrying these two in his buckboard every day.

Election of Directors

The board of councillors met this morning and voted upon nominations for the board of directors to fill places of memberships which expire at this meeting. The Institute at the general meeting of all members present at the convention held this afternoon ratified the action of the board of councillors and elected the following as directors of the Institute:

B. B. Brooks, Consolidated Royalty Oil Corp., Casper, Wyo.; E. W. Clark, Union Oil Co., Los Angeles; W. N. Davis, Phillips Petroleum Co., Bartlesville; T. A. Dines, Midwest Refining Co., Denver; C. M. Fuller, Richfield Oil Co., Los Angeles; Henry L. Doherty, H. L. Doherty & Co., New York; O. D. Donnell, Ohio Oil Co., Findlay; L. J. Drake, Union Tank Car Co., Chicago; H. B. Earhart, White Star Refining Co., Detroit; W. S. Fitzpatrick, Prairie Oil & Gas Co., Independence; H. V. Foster, Indian Territory Illuminating Oil Co., Bartlesville; W. C. Franklin, Tidal Oil Co., Tulsa; John L. Gray, Shaffer Oil & Refining Co., Tulsa; R. C. Holmes, The Texas Company, New York; W. M. Irish, Atlantic Refining Co., Philadelphia; F. A. Leovy, Gulf Production Co., Pittsburgh; J. F. Lucey, Lucey Petroleum Co., Dallas; E. W. Marland, Ponca City; Edgar J. Marston, Texas Pacific Coal & Oil Co., Fort Worth; P. M. Miskell, Empire Oil & Refining Co., Tulsa; W. T. Holliday, Standard Oil Co. of Ohio, Cleveland; H. C. Morris, Dallas Gas Co., Dallas, Tex.; Thomas A. O'Donnell, Los Angeles; J. Edgar Pew, Sun Oil Co., Dallas; Frank Phillips, Phillips Petroluem Co., Bartlesville; Herbert L. Pratt, Standard Oil Co. of New York, New York; Wallace E. Pratt, Humble Oil & Refining Co., Houston; E. G. Seubert, Standard Oil Co. of Indiana, Chicago; H. F. Sinclair, Sinclair Consolidated Oil Corp., New York; Charles L. Suhr, Pennzoil Co., Oil City; J. W. Vandyke, Atlantic Refining Co., Philadelphia; E. T. Wilson, Continental Oil Co., Denver; Edward T. Moore, Simms Oil Co., Dallas; Jacob France, Mid-Continent Petroleum Corp., New York; Wirt Franklin, Wirt Franklin Petroleum Corp., Ardmore; C. B. Ames, The Texas Company, New York; Oscar Sutro, Standard Oil Co. of California, San Francisco; E. B. Reeser, Barnsdall Corp., Tulsa; Waite Phillips, Independent Oil & Gas Co., Tulsa; W. C. McDuffie, Pacific Western Oil Co., Los Angeles; F. B. Parriott, Transcontinental Oil Co., Tulsa.

Intense interest had been manifested here in what Sir Henri Deterding would say in the course of his address which featured the general meeting held this afternoon. This interest had been intensified by statements purported to have been made by Sir Henri upon his arrival last week in New York.

Mr. Reeser was given a splendid ovation when he rose to deliver the president's address at this afternoon's general meeting.

Group Sessions

During the next two days matters to be discussed at this convention by the different branches of the industry will be taken up in group sessions. The convention will close Thursday night with the annual dinner.

Group meetings on December 4 will consider production practice, refinery technology, motor fuel and automotive transportation. Deep drilling and straight holes will come up for extensive discussion in the group sessions on drilling and production practice. The group meeting on refinery technology and motor fuel will consider the possibility of standardizing antiknock testing methods. Use of injected air and natural gas in producing oil will come up for discussion tomorrow, also, while cracking methods will be the subject of talks by men in the industry regarded as experts in this line. Taxation, the code of ethics, corrosion and other pertinent subjects are on the programs of the various group meetings scheduled for Wednesday and Thursday.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

G 1/2 (1929)
R.S.A

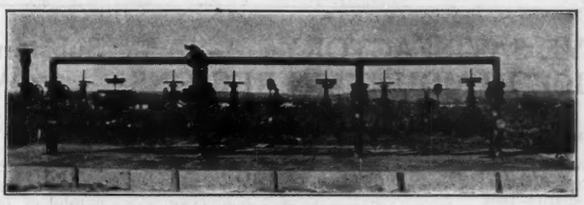
GASOLINE TAXES - FIRST HALF YEAR OF 1929

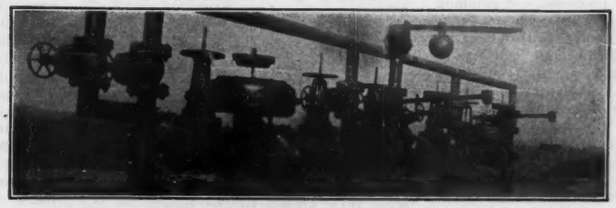
TAX EARNED ON MOTOR VEHICLE FUEL, ETC., DISPOSITION OF FUND, AND GALLONS TAXED

(FROM REPORTS AND RECORDS OF STATE AUTHORITIES)

STATE	GROSS TAX ASSESSED PRIOR TO DEDUCTION OF REFUND	EXEMPTION REFUND: (DEDUCTED FROM GROSS TAX)	TOTAL TAX EARNING ON FUEL FOR MOTOR VEHICLES	OTHER RECEIPTS UNDER TAX LAW (LICENSES)	GRAND TOTAL EARNING (TAX AND OTHER RECEIPTS)	COLLECTION COST	DISPOSITION OF GRAND TOTAL EARNING: CONSTRUCTION & MAINTENANCE OF RURAL ROADS — STATE HIGHWAY	CONSTRUCTION & MAINTENANCE OF RURAL ROADS — LOCAL ROADS	STATE & COUNTY ROAD BOND PAYMENT	FOR MISCELLANEOUS PURPOSES	TAX RATE, 1929: CENTS PER GALLON — JAN. 1st	TAX RATE, 1929: CENTS PER GALLON — JUNE 30	DATE OF RATE CHANGE	NET GALLONS OF GASOLINE TAXED AND USED BY MOTOR VEHICLES	STATE
ALABAMA	$3,319,306	--	$ 3,319,306	1/ $10,377	$ 3,329,683	$17,684	$ 982,989	$ 1,658,978	$ 669,832	--	4	4		82,982,649	ALABAMA
ARIZONA	1,372,592	$ 170,672	1,201,920	4	1,201,924	2/ --	751,204	450,720	--	--	4	4		30,048,012	ARIZONA
ARKANSAS	2,975,986	--	2,975,986	--	2,975,986	89,280	743,996	475,158	3/1,666,552	--	5	5		59,519,727	ARKANSAS
CALIFORNIA	17,680,059	1,656,784	16,023,275	--	16,023,275	12,339	10,673,957	5,336,979	--	--	3	3	-	534,109,165	CALIFORNIA
COLORADO	2,423,815	165,128	2,258,687	585	2,259,272	4/ 22,146	1,565,988	643,291	--	5/$ 27,847	3	4	5/1	67,497,095	COLORADO
CONNECTICUT	1,762,028	--	1,762,928	38,074	1,800,102	--	1,800,102	--	--	--	2	2		88,101,396	CONNECTICUT
DELAWARE	436,698	17,214	419,484	--	419,484	--	419,484	--	--	--	3	3		13,982,812	DELAWARE
FLORIDA	5,993,304	--	5,993,304	12,045	6,005,349	12,045	3,595,982	1,198,661	--	6/ 1,198,661	5	5	-	119,866,085	FLORIDA
GEORGIA	4,066,983	--	4,066,983	--	4,066,983	4,200	2,539,239	1,015,696	--	7/ 507,848	4	4	-	101,674,584	GEORGIA
IDAHO	842,649	77,508	765,141	--	765,141	8,939	756,302	--	--	--	4	4		19,128,535	IDAHO
ILLINOIS 8/	--	--	--	--	--	--	--	--	--	--	-	-		8/ -	ILLINOIS 8/
INDIANA	7,147,029	243,736	6,903,293	267	6,903,560	11,619	5,168,956	1,292,239	--	10/ 430,746	3	4	4/1	194,262,855	INDIANA
IOWA	4,354,471	318,668	4,035,803	--	4,035,803	10,227	2,371,576	1,654,000	--	--	3	3	-	134,526,754	IOWA
KANSAS	4,013,474	375,861	3,637,613	--	3,637,613	11/ --	2,837,613	800,000	--	--	2	3	4/1	137,589,613	KANSAS
KENTUCKY	3,393,491	--	3,393,491	6,109	3,399,600	12,839	3,386,761	--	--	--	5	5		67,869,832	KENTUCKY
LOUISIANA	3,140,033	235	3,139,798	--	3,139,798	11/ --	2,376,642	--	763,156	--	2	4	1/4	80,674,322	LOUISIANA
MAINE	1,378,808	42,014	1,336,794	--	1,336,794	8,758	830,023	498,013	--	--	4	4	-	33,069,734	MAINE
MARYLAND	2,737,643	88,144	2,649,499	--	2,649,499	1,250	2,118,599	--	--	12/ 529,650	4	4	-	66,237,483	MARYLAND
MASSACHUSETTS	4,413,428	63,501	4,349,927	--	4,349,927	--	3,027,550	930,884	230,546	10/ 160,947	2	2		217,496,356	MASSACHUSETTS
MICHIGAN	10,605,138	961,631	9,643,307	325	9,643,632	60,000	2,101,307	5,400,000	2,082,000	325	3	3	-	321,443,578	MICHIGAN
MINNESOTA	3,530,079	196,128	3,333,951	--	3,333,951	13/ --	2,722,771	611,180	--	--	2	3	5/1	136,138,526	MINNESOTA
MISSISSIPPI 14/	3,376,618	--	3,376,618	--	3,376,618	2,700	1,284,425	1,986,048	--	15/ 103,445	5	5	-	68,255,606	MISSISSIPPI 14/
MISSOURI	3,484,007	62,298	3,421,709	--	3,421,709	33,050	3,388,659	--	--	--	2	2	-	171,085,442	MISSOURI
MONTANA	1,423,363	259,627	1,163,736	--	1,163,736	6,621	1,157,115	--	--	--	3	5	4/1	24,748,641	MONTANA
NEBRASKA	3,322,204	16,645	3,305,559	--	3,305,559	3,750	2,614,899	686,910	--	--	2	4	4/1	96,521,352	NEBRASKA
NEVADA	302,819	20,978	281,841	--	281,841	--	229,610	52,231	--	--	4	4	-	7,046,023	NEVADA
NEW HAMPSHIRE	880,655	26,963	853,692	--	853,692	304	640,041	--	213,347	--	4	4	-	21,342,298	NEW HAMPSHIRE
NEW JERSEY	4,505,725	--	4,505,725	11,362	4,517,087	9,000	4,463,087	--	--	16/ 45,000	2	2	-	225,286,231	NEW JERSEY
NEW MEXICO	1,015,565	--	1,015,565	3,696	1,019,261	20,385	781,876	--	217,000	--	5	5	-	20,311,308	NEW MEXICO
NEW YORK 17/	4,728,954	47,972	4,680,982	--	4,680,982	14,573	3,462,307	923,282	--	18/ 280,820	-	2	5/1	19/ 234,049,092	NEW YORK 17/
NORTH CAROLINA	5,280,726	210,528	5,070,198	--	5,070,198	5,070	2,493,418	211,710	2,360,000	--	4	5	3/4	121,362,169	NORTH CAROLINA
NORTH DAKOTA	900,033	372,033	528,000	648	528,648	12,000	516,648	--	--	--	2	2	-	26,400,010	NORTH DAKOTA
OHIO	15,058,842	435,867	14,622,975	--	14,622,975	--	9,139,359	2,924,595	--	10/ 2,559,021	3	4	4/17	427,495,801	OHIO
OKLAHOMA	4,265,073	13,199	4,251,874	--	4,251,874	--	2,855,765	1,396,109	--	--	3	4	6/22	143,928,743	OKLAHOMA
OREGON	2,098,474	155,458	1,943,016	--	1,943,016	3,569	1,939,447	--	--	--	3	3	-	65,118,022	OREGON
PENNSYLVANIA	14,785,596	--	14,785,596	--	14,785,596	--	12,321,330	2,464,266	--	--	3	3	-	492,853,153	PENNSYLVANIA
RHODE ISLAND	722,514	55,097	667,417	--	667,417	20/ --	500,563	--	166,854	--	2	2	-	33,370,839	RHODE ISLAND
SOUTH CAROLINA	3,097,617	12,334	3,075,283	1,602	3,076,885	--	2,197,538	879,347	21/ --	--	5	6	3/16	54,849,377	SOUTH CAROLINA
SOUTH DAKOTA	1,712,153	649,594	1,062,559	--	1,062,559	5,500	634,351	--	422,708	--	4	4	-	26,563,978	SOUTH DAKOTA
TENNESSEE	3,920,901	--	3,920,901	--	3,920,901	19,604	2,340,778	780,259	780,260	--	3	5	2/17	86,710,635	TENNESSEE
TEXAS	7,220,581	--	7,220,581	--	7,220,581	--	5,415,741	--	--	22/ 1,804,840	2	2	-	361,029,066	TEXAS
UTAH	871,277	--	871,277	152	871,429	2,263	95,266	--	773,900	--	3½	3½	-	24,893,622	UTAH
VERMONT	591,101	--	591,101	--	591,101	--	591,101	--	--	--	3	4	4/1	16,170,984	VERMONT
VIRGINIA	4,610,263	229,345	4,380,918	--	4,380,918	23/ --	3,066,643	1,314,275	--	--	5	5	-	87,618,352	VIRGINIA
WASHINGTON	2,318,711	177,473	2,141,238	--	2,141,238	--	2,141,238	--	--	--	2	2	-	107,061,898	WASHINGTON
WEST VIRGINIA	2,121,927	76,522	2,045,405	--	2,045,405	--	545,406	--	1,500,000	--	4	4	-	51,135,119	WEST VIRGINIA
WISCONSIN	3,196,859	229,620	2,967,239	--	2,967,239	5,000	1,090,769	1,657,876	--	10/ 213,574	2	2	-	148,361,963	WISCONSIN
WYOMING	418,140	147	417,993	--	417,993	754	387,364	49,875	--	--	3	4	4/1	12,268,495	WYOMING
DIST. OF COL.	680,164	3,858	676,306	--	676,306	--	--	--	--	10/ 676,306	2	2	-	33,815,279	DIST. OF COL.
TOTAL	--	--	175,054,894	85,246	175,140,140	415,569	117,045,804	37,293,582	11,846,155	8,539,030	AVER RATE 3.07			24/ 5,693,872,662	TOTAL

NOTES:-
1/ BACK TAXES ON 516,839 GALLONS AT 2 CENT TAX.
2/ PAID $4,550 FROM STATE HIGHWAY FUND
3/ ONLY ABOUT 1/7TH FOR STATE BONDS
4/ INCLUDES EXPENSES OF STATE INSPECTOR OF OILS
5/ FOR CITY AND TOWN STREETS
6/ INCLUDES $799,107 FOR PUBLIC SCHOOLS, AND $399,554 FOR PERMANENT BUILDING FUND
7/ FOR PUBLIC SCHOOLS
8/ GASOLINE TAX OF 3 CENTS NOT EFFECTIVE UNTIL AUGUST 1
9/ ESTIMATED CONSUMPTION (NOT TAXED) 390,000,000 GALLONS
10/ FOR CITY STREETS
11/ FROM STATE GENERAL FUND, $7,500
12/ FOR BALTIMORE CITY STREETS AND CITY GRADE CROSSING ELIMINATION.
13/ APPROPRIATED ABOUT $8,250 FROM STATE TREASURY
14/ INCLUDES EARNINGS FROM ADDITION TAX IN HARRISON AND HANCOCK COUNTIES
15/ FOR SEA-WALL TO PROTECT ROAD.
16/ FOR STATE DEPARTMENT OF COMMERCE AND NAVIGATION
17/ FIGURES COVER ONLY MONTHS OF MAY AND JUNE
18/ INCLUDES $50,000 IN REVOLVING FUND, AND $230,820 TO N. Y. CITY
19/ ESTIMATED CONSUMPTION OF FIRST FOUR MONTHS NOT TAXED 391,000,000 GALLONS.
20/ STATE APPROPRIATION, $5,000.
21/ PAYMENTS ON COUNTY BONDS INCLUDED WITH LOCAL ROAD ALLOTMENT
22/ FREE SCHOOL FUND
23/ STATE APPROPRIATION, $5,816
24/ APPROXIMATE GRAND TOTAL CONSUMPTION INCLUDING GASOLINE NOT TAXED IN ILLINOIS AND NEW YORK, 6,475,000,000 GALLONS.





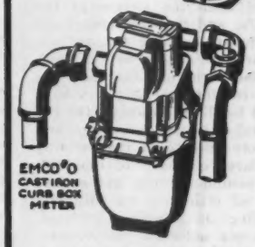
Keep the Pressure Constant

IT'S easy to do with EMCO Regulators. And a big feature in the design of these regulators is the interchangeability of parts. Valve assemblies are easily and quickly changed. No need to take the regulator out of the line—remove the hand hole plate and the working parts are readily accessible, and the entire working mechanism replaceable as a unit. This means that repairs and adjustments may be made on the job.

In Texas it's EMCO—wherever you go. The installation above shows two EMCO High Pressure Regulators, one EMCO Low Pressure Regulator, and an EMCO ball and lever type safety valve.

EMCO #0
CAST IRON
DRY GAS METER

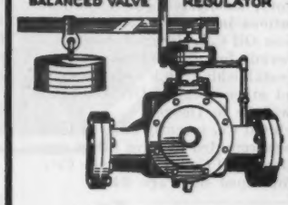
IRONCLAD
CAST IRON
DRY GAS METER



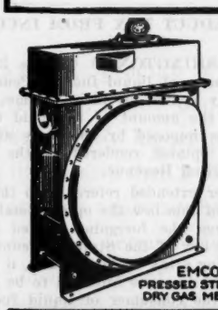
EMCO #0
CAST IRON
CURB BOX
METER

EMCO
TIN METER

EMCO HIGH PRESSURE
BALANCED VALVE REGULATOR



EMCO WATER HEATER
AND GAS APPLIANCE
REGULATOR



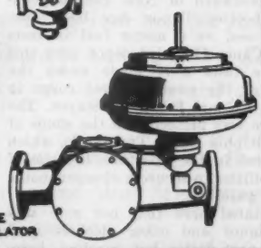
EMCO #5
PRESSED STEEL TYPE
DRY GAS METER

WESTINGHOUSE
FLUID POSITIVE
GAS METER

EMCO
LARGE CAPACITY
CAST CASE DRY
GAS METER WITH
EMCO COMBINED
RECORD GAUGE

EMCO
ORIFICE GAS METER

EMCO
DOMESTIC SERVICE
REGULATOR



EMCO LOW PRESSURE
BALANCED VALVE REGULATOR

PITTSBURGH EQUITABLE METER COMPANY

MAIN OFFICE AND WORKS PITTSBURGH, PA.

NEW YORK CHICAGO COLUMBIA, S.C. LOS ANGELES DALLAS
TULSA SEATTLE KANSAS CITY SALT LAKE CITY

Of Interest to Sales Departments

Many Changes Made In Rocky Mountain Station Operations

DENVER, Colo., Nov. 30.—A number of changes have taken place recently in the marketing of petroleum products in the Rocky Mountain area, several of which resulted from the merger of the Marland Oil Co. and the Continental Oil Co. The Midwest Refining Co. is now distributing direct to dealers and consumers the Polarine brand of motor oils and greases which for the past 20 years have been marketed by the Continental Oil Co. The Continental, prior to the merger, and especially before it entered the refining field, was a large customer of the Midwest. The Vacuum Oil Co. has opened a large suite of offices in the Midland Savings Building in Denver as headquarters for a new sales division embracing Colorado, Wyoming and New Mexico. Its brands, Gargoyle Mobiloil and Gargyle lubricating oils, formerly were sold in this territory by the Continental. C. G. Swank, who was in charge for the Vacuum company at Milwaukee, is general manager of the Denver division. Thomas Colcott, who represented the company in Denver in the past, has been named automotive manager, and H. S. Evans, who directed sales for the company's industrial lubricants at Albany, N. Y., is industrial manager of the new division. Several warehouses will be opened at Denver and at other strategic points, including Pueblo.

The Phillips Petroleum Co. is entering this territory, also, having purchased 10 service stations in Denver recently from the Morrison Oil Co. It has taken out a building permit for a warehouse in Denver and establishing bulk stations at Pueblo and other points. District headquarters will be in Denver.

The Shell Oil Co. recently entered Utah where it was reported to have taken over the Rich Gas & Oil Co. at Salt Lake City,

(Continued on Page 243)

USE BOOTLEG LIQUOR AS FUEL WITH NEW DEVICE

BALTIMORE, Md., Nov. 30. — With a gas generator invented by Ernest R. Godward of New Zealand confiscated bootleg liquor has been successfully used as a motor fuel in tests made at Camp Holabird depot near this city. The tests were made under the direction of the quartermaster corps in charge of Colonel Edgar S. Stayer. The new device was perfected in the shops of the Philadelphia Rapid Transit Co. which is interested in the invention because of the possibilities to secure a cheaper motor fuel than gasoline.

It is stated here that not only was bootleg liquor and other alcohols used with the new device but gasoline, kerosene, gas oil and fuel were separated and vaporized into a dry gas suitable for an internal combustion engine.

According to a report "the alcohols used included grades issued for vehicle radiators in cold weather, industrial grades, the alcohol by-product of the sugar cane industry, samples obtained from the Philippine Islands and several grades of bootleg liquor. From results obtained, utilizing furnace oil as a fuel, it is apparent that this fuel can be satisfactorily used with the vaporizer for the operation of existing equipment. This is a valuable asset to certain types of equipment where fire hazards are to be reckoned with, as in armored cars and tanks. The volatility of the fuel oil utilized was such that it could not be ignited when spread on the metal floor of a tank and a flame applied."

OIL ROADS GIVE SATISFACTORY SERVICE IN MOUNTAIN REGIONS

By. S. H. Diggs
Research Department, Standard Oil Co. of Indiana*

The problem of building suitable highways in the intermountain region is perhaps even more difficult of solution than in other parts of the country. At any rate we have some problems not common to the East or Pacific Coast. The two outstanding reasons for this difference are (1) lack of population and scarcity of taxable property, (2) climatic conditions particularly lack of moisture, and high winds. We have as much need for good highways as have the thickly populated sections of the country, perhaps even more, for our distances are long and fairly high speed on the road is more essential than in the East. On the other hand we have not the means to build very expensive types of road. What type of road can be built at moderate cost that will meet these conditions? After years of thought and observation, I am thoroughly convinced that the solution of the problem lies in properly constructed oiled roads. Fortunately we have all of the raw materials available within our own territory.

In considering various types of construction for highways it is necessary that we disabuse our minds of old prejudices no matter how well established by time and usage, unless these prejudices have a sound basis in actual fact applicable to our conditions. One old prejudice is that construction of this class should be permanent, that is to say, should be of the type which will last the greatest possible time with the least possible upkeep. At first sight it might seem that this is almost axiomatic, but a study of the question will show that it is a mere prejudice based on ancient facts and experiences, much of which is not applicable to present conditions.

Throughout modern industry we note a movement away from permanent types of construction and toward comparatively short lived equipment. There are two reasons for this. We have learned that no matter how desirable a certain type of construction may be today, that it is very probable that it will not be desirable after 10 or 20 years, to say nothing of centuries hence. The pyramids were constructed to last for thousands of years. They have done so, but who wants a pyramid today? Many of the medieval churches of Europe were constructed to last through the ages but they no longer suit modern conditions, in fact almost their sole value is as works of art or curios. I take it that we do not desire to construct roads for the benefit of the archeologists of future generations. In many cases the route which seems wisest for a highway at a given time will have to be abandoned in future years. Grades which are acceptable at one time will be condemned at another. A bridge properly located in the light of present knowledge may be very badly located from the point of view of an engineer 20 years hence.

Construction of Road

The method used in this region for building oiled roads may be outlined briefly as follows: After a road has been properly graded it is allowed to go through one winter under traffic without any surfacing whatever. That is, no gravel or road metal is placed on it. Experience has shown that this is necessary to secure a firm foundation. The next summer 3½ to 4 inches of gravel is put on the road. This gravel is leveled off with a blade but not rolled. The road is then opened to traffic. One year is allowed to elapse before any work is done on the road other than blading if necessary or possibly filling a few holes. After one year of use this graveled road is again given about 2 inches of finer gravel. By this time, experience shows that the base should be well compacted, at least for the width of 18 feet, though the edges are still apt to be soft. As soon as possible after applying the top coat of fine gravel the road is scarified to the depth of 3 to 4 inches. Three-fourths to one gallon of oil is applied per square yard. This is worked in with disc harrows then bladed to the middle of the road and again spread out. Another application of oil about the same as the first is applied, making a total of approximately 2 gallons per square yard (the exact amount is varied somewhat according to the nature of the gravel and other conditions). This is now repeatedly harrowed, and bladed back and forth, until the mixture appears completely homogeneous to the eye. It is then smoothed with the blade leaving a small amount of crown for drainage. No shoulders are left on the road as experience show that shoulders impound water and injure the road. The road is not rolled but is opened immediately to traffic.

This method of road building is an evolution from the method used for the last six years or so in California. Experience shows that it makes a very satisfactory road at low cost. Too much emphasis can not be placed on the question of cost. At least this is true for Wyoming. We have so many miles of road in this State in proportion to the taxable property that any method of road building which is very expensive is automatically eliminated.

Cost of Construction

Starting with the graded gumbo road which would be necessary, no matter what the surface, the cost of building the above type of road is about as follows:

	Per mile
Gravel first year	$2.500
Gravel second year	2,500
Oil, labor and overhead for converting gravel to oiled road	1,500
Total cost exclusive of earth base and grading	$6,500

Of course this is an average figure. Variations as great as $1,500 or $2,000 per mile may occur according to the distance the gravel has to be hauled and other conditions.

It will be noted here that we have a first class, one might say unexcelled, road for the comparatively small figure of $6,500 per mile. Further, that the road is fully 20 feet wide and an 18-foot (minimum width) concrete road will cost $20,000 or more per mile and an asphalt road of equal width will cost from $25,000 to $30,000 per mile. It is a safe assumption that the average concrete or asphalt road would cost $26,500 per mile. The difference in construction between such a road and an oiled road would be $20,000 per mile. Assuming money borrowed by the State to cost 5 per cent, this would mean a saving of $1,000 per year for each mile of road in interest and therefore available if necessary for repairs. Even if we used the lower figure of $24,500 per mile average cost for permanent road the interest saving would still be $900 per mile each year. It has been shown quite conclusively that $400 per mile each year is ample to maintain

(Continued on Page 244)

*Annual meeting Rocky Mountain Oil and Gas Association, Casper Wyo., November 20-21.

Substantial Gain In Western States Fuel Oil Demand

Deliveries of gas oil and fuel oil in the 26 Central States lying between the Pacific and Atlantic Coast areas reached a total of 138,224,000 bbls. in 1928, an increase of 9,289,000 bbls., or 7.2 per cent, over the corresponding deliveries of 128,935,000 bbls. in 1927, says the United States Bureau of Mines, Department of Commerce, in summarizing the results of a statistical survey made by A. T. Coumbe, Jr. Included in these totals are exports to foreign countries of 9,787,000 bbls. in 1927 and 12,505,000 bbls. in 1928. Excluding these exports from the totals, domestic deliveries within the area outlined were 125,719,000 bbls. in 1928, a gain of 5.5 per cent over the 1927 domestic deliveries of 119,148,000 bbls. This increase in domestic demand for fuel oil within the Central United States came largely from the iron and steel industry, commercial and domestic heating, and from the petroleum industry itself for fuel and refinery operations.

The Central United States includes three separate marketing areas—the Rocky Mountain States, North Central States, and South Central States. Of these three areas, the North Central alone has shown an increased demand for fuel oil over the past three-year period. Both the Rocky Mountain and South Central areas showed a smaller demand for fuel oil in 1928 than in 1926, but the North Central area, comprising the states adjacent to the Great Lakes, has shown consistent increases in fuel-oil demand; the 1928 total was 52 per cent greater than the demand in 1926. Outstanding among the factors contributing to the increase shown in the North Central area were deliveries for commercial and domestic heating, the total for this purpose being increased from 2,517,000 bbls. in 1926 to 7,112,000 bbls. in 1928.

Natural gas developments during the past three years have extended the geographical distribution of this fuel

(Continued on Page 243)

DEDUCT TAX FROM INCOME

WASHINGTON, D. C., Nov. 30.—The consumers of liquid fuel in Pennsylvania may deduct in their income tax returns the amount of tax paid on such fuel as imposed by the state according to an opinion rendered by the Bureau of Internal Revenue.

After extended reference to the provisions of this law the opinion states:

"From the foregoing quoted sections of the law of the State of Pennsylvania imposing a tax on liquid fuels, it appears that the tax was intended to be imposed upon the consumer of liquid fuels, and not upon the dealer. In accordance with the provisions of section 23 (c) of the Revenue Act of 1928 and Article 151 of Regulations 74, it is held that the tax in question is deductible in the income tax return of the consumer who pays it. If, however, such tax is added to or made a part of the business expenses of such consumer, it cannot be deducted by him separately as a tax."

FIRST JAVA-PACIFIC SHIPMENT

LOS ANGELES, Calif., Nov. 30.—The first shipment of petroleum products on the Java-Pacific line has been made from a local refinery. A total of 30,000 cases of petroleum products were lifted aboard the Java-Pacific motorship Modjokerto. Other cased goods and merchandise were a part of the cargo.

"It's *cheaper* to use Ethyl"

LIKE any product of superior quality, Ethyl Gasoline is cheaper in the long run.

The slightly higher price of Ethyl (the difference amounts to a little more than a dollar per month for the average driver) is more than offset by the saving of wear and tear on your engine; fuel is saved because there is less running in second, owing to the added power of Ethyl. There is less overheating and vibration, consequently slower depreciation, and you will note a marked saving in repair bills at the end of the year.

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Ethyl is essential to the high-compression engine. But Ethyl eliminates the "knock" from *any* engine, thus developing power impossible to obtain with ordinary gasoline.

Start riding with Ethyl today. See how it brings down your operating costs. Look for the Ethyl emblem.

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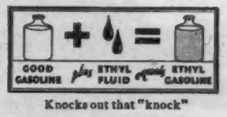

Knocks out that "knock"

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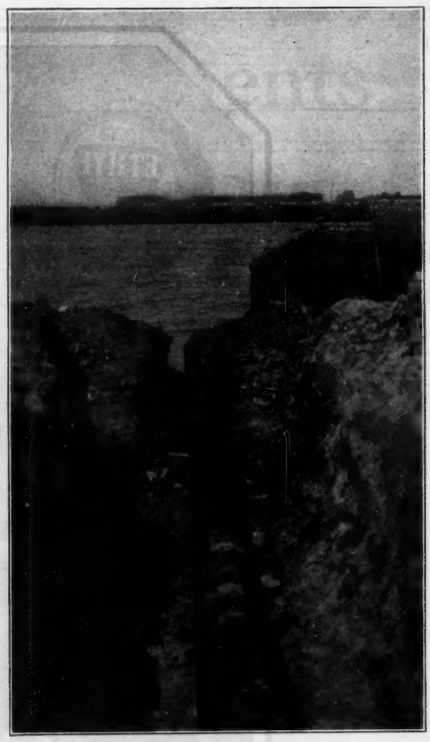
in any soil condition

NO-OX-ID "G" and "G Special" are now applied cold. Results: Lower labor cost in application; less equipment required, reduced fire hazards.

There are three NO-OX-ID-IZED Wrappers: (1) Our proven brown fabric wrapper (2) Asbestos felt; gray in color (3) Fabric treated with gray NO-OX-ID.

The nature of the soil determines which shall be used.

These new developments invite consideration of NO-OX-ID from the standpoints of greater initial economy and scientifically reliable adaptability to any soil condition.



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TRADE MARK
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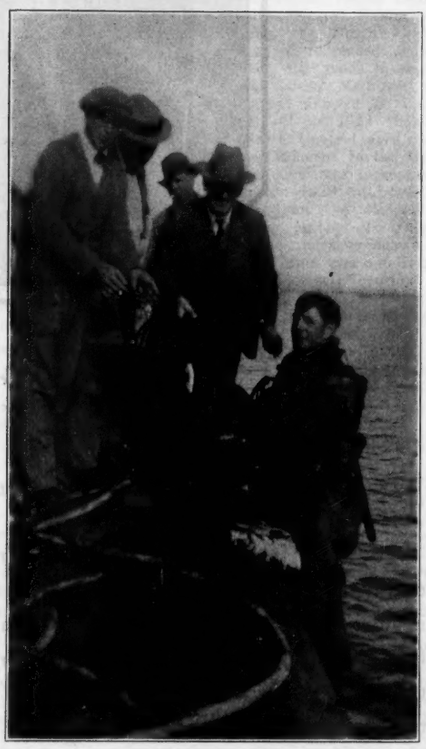
NO-OX-ID and NO-OX-ID-IZED Wrapper have been used as the illustrations show on many types of work where uninterrupted service of the lines for the greatest possible length of time is the first consideration.

Now, with the new economies developed, with the added years of protection assured, these products become the most economical protection you can use under *any* condition. Let us prove this to you with facts and figures.

Dearborn Methods are positive and proven.

Dearborn Service men are in the fields servicing pipe line jobs.



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NEW YORK CHICAGO

USE OF ALUMINUM AS CORROSION RESISTANT

(Continued from Page 112)

very high hydrogen sulphide content. Exact details of these installations are not available, but all information which can be obtained indicates that the aluminum equipment is giving excellent service. This would be expected from the general properties of aluminum and aluminum alloys. The most successful applications would probably be to heat exchanges, to gas lines handling corrosive gas, to absorbers and condensors, etc.

Use of Aluminum in Large Storage Tanks

The corrosion of large tanks in which high sulphide crude oil or refined products are stored or handled causes very great losses. The excellent corrosion resistance of aluminum to sulphide bearing gases makes it particularly applicable for combating this corrosion. Due to the high cost, however, it is not feasible to use aluminum for the construction of a solid roof designed along the lines of the usual steel roof. Such an aluminum roof would cost four or five times as much as a steel roof. It is questionable if normal tank corrosion conditions can ever warrant this expenditure, especially since less costly methods of defeating this corrosion are available.

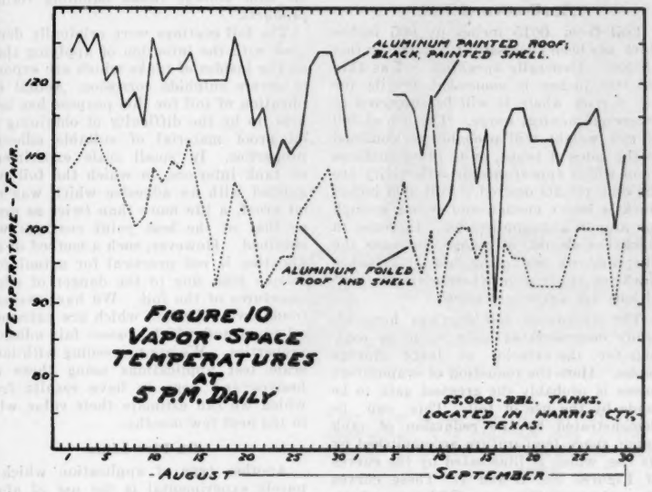


FIGURE 10
VAPOR-SPACE TEMPERATURES AT 5 P.M. DAILY

Light gauge aluminum has proved its value as a sheathing over wooden decks of tanks handling highly corrosive crudes. On a tank of the Gulf Pipe Line Co., where this procedure was used, the 26-gauge aluminum sheathing showed no corrosion after one year of service. Galvanized steel sheathing of the same weight had pitted very badly in less than two years. Here the first cost of the aluminum was not at all prohibitive, since the cost of the metal sheathing represented only a small part of the cost of the tank roof job. In addition to the corrosion reduction, the aluminum sheathing may be expected to effect an appreciable reduction of evaporation losses.

Aluminum alloys are widely used for various small items of tank equipment. In West Texas, nails made of 17S are widely employed in the construction of wooden tank decks. The working parts of tank breathers and flame arrestors are cast of aluminum alloys. Floats and chains for automatic tank gauges are being fabricated of aluminum. In all of these applications quite successful results are being obtained.

By the use of aluminum foil, which will be discussed in some detail later, it will probably be possible to take much fuller advantage of the corrosion resistance of aluminum in the construction of tanks.

Use of Aluminum in Oil Refineries

In refineries there exist certain conditions under which the use of solid aluminum tank decks will be justifiable. Extremely severe corrosion is experienced on rundown tanks when refining some oils of high sulphur content. Aluminum has demonstrated excellent corrosion resistance under these conditions. Where the corrosion is extremely severe, it is possible that the cost of solid aluminum decks will be justified by the savings possible. Actual installations of this type have been made, and from all available information appear to be giving very good service. The fact that such a costly installation can be justified only by exceptionally severe corrosive conditions must be emphasized.

Due to the high temperatures and pressures which are dealt with in modern refinery operation, the uses of aluminum and aluminum alloys in still equipment are distinctly limited. Wilson and Bahlke[2] found that aluminum possessed an excellent resistance to corrosion under certain pressure still conditions. These data, however, are not particularly significant in view of the high temperatures and pressures mentioned above. It is possible that aluminum linings might find some use in still construction.

Another factor which mitigates against the use of aluminum in refineries is the presence in many portions of the equipment of more or less hydrochloric acid. This makes dubious the success of aluminum in many possible refinery applications such as bubble towers, condensors for crude stills, etc. Neutralization of the hydrochloric acid by ammonia will not reduce this corrosion; neutralization by caustic soda might be successful, provided the caustic could be kept from coming into contact with the aluminum. It seems probable, therefore, that the main applications of aluminum and aluminum alloys in refinery practice will be confined to various small pieces of equipment which are not subjected to extremely high temperatures or pressures but which are rather rapidly corroded. Examples of such applications are small transfer lines, the covers of lookboxes, etc.

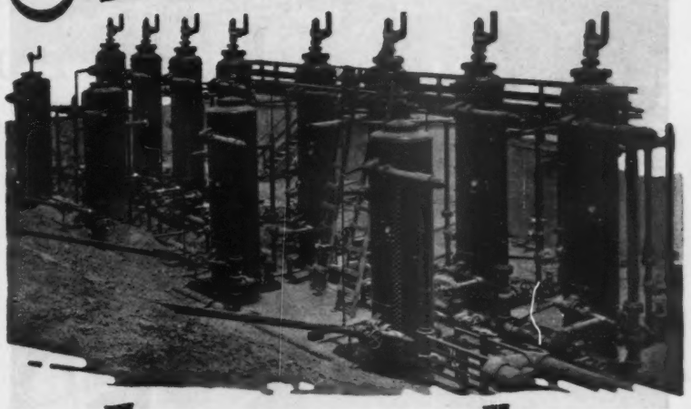
Use of Aluminum Foil

Recently developed processes for the application of aluminum foil promise to make possible a very great extension of the use of aluminu in the oil industry. The development of these processes is largely due to the efforts of S. U. McGary and Walter F. Rogers of the Gulf Oil Co.s' research department. Although the method is still very much in the experimental stage, it has already been demonstrated conclusively that it possesses great value for a number of purposes.

The essential feature of the application of aluminum foil as a protective coating by this method is in the selection of a suitable adhesive material which will hold it tightly to the surface to be protected. The requirements for successful adhesive are extremely rigid and only two or three out of the large number which have been submitted to us since we have ben experimenting with the process, have proven entirely satisfactory. With an adhesive

[2]Industrial and Engineering Chemistry, 17 355 (1925).

Ask the Men



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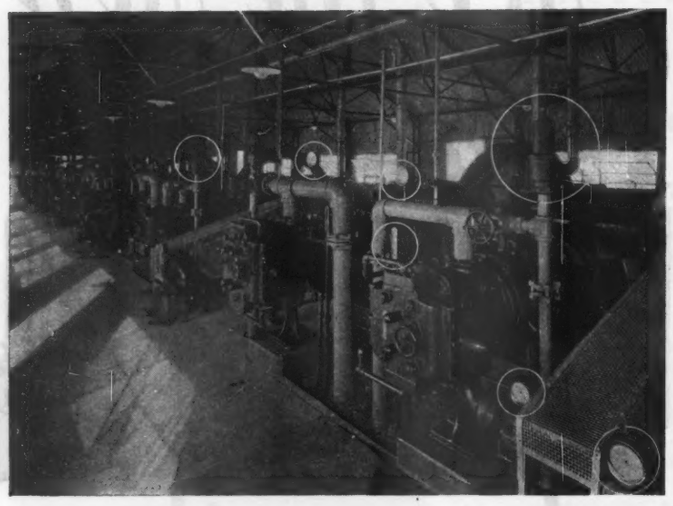

An Air Lift plant designed and erected by Dresser & Gorton for the Slick Oil Co. Among the instruments shown are American Indicating Glass Thermometers, single and double spring Pressure Gauges, Hydraulic Pressure Gauges and Hydraulic Relief Valves.

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of suitable properties, the application of the foil is surprisingly simple. It is not damaged by rough handling and can be worked over and into irregularities of the surface with little trouble. The only important requirements in the application are that the adhesive should possess the proper degree of tackiness and stickiness and that all air bubbles should be forced from beneath the foil during application. The impossibility of sticking the foil over air bubbles will cause them to form somewhat unsightly blisters. These blisters, unless extremely large, will not seriously interfere with the protection afforded by the coating. Aside from the simple precautions which are necessary to overcome this condition, the application does not require any particular care or skill. An idea of the labor requirement may be gained from the fact that the roof of an 80,000-bbl. tank can be completely coated with foil by using 12 man days of labor; even this figure can probably be reduced by certain slight changes in method of application.

Application of Foil

Foil from .0015 inches to .005 inches thick has been successfully applied by this method. Generally speaking, foil as thin as .002 inches is somewhat fragile for any service where it will be subjected to severe mechanical usage. The use of foil of this weight will probably be confined to the sides of tanks, or to other surfaces upon which appearance or reflectivity are the only results desired. Foil .003 inches thick is heavy enough and strong enough for almost any application. Increase in thickness should, of course, increase the life; and we are using foil .005 inches thick for application where corrosive conditions are extremely severe.

The aluminum foil coatings have already demonstrated their value as coatings for the exterior of large storage tanks. Here the reduction of evaporation losses is probably the greatest gain to be made by the use of foil. This can be demonstrated by the reduction of tank vapor space temperature accomplished by its use, which is illustrated by the curves of Figures No. 6 and 7. These curves show the variation, over 24-hour periods, in vapor space temperatures of three 80,000-bbl. tanks, one of which is unpainted, one of which is coated entirely with aluminum paint and the third of which has an aluminum foil coated deck and aluminum-painted sides. The test of these tanks has not proceeded far enough to make it possible to compare evaporation losses, but preliminary measurements indicate that the tank which has the aluminum foil coating on its deck has an evaporation rate only about one-half as great as that of the tank which is painted entirely with aluminum paint.

Temperature Reduction

A similar temperature reduction is illustrated by data upon two 55,000-bbl. tanks, one of which is coated entirely with aluminum foil and the second of which has an aluminum painted roof and a black shell. Temperature reading of the gas and oil of these tanks were taken at 7 a.m. and 5 p.m. daily. The 5 p.m. gas temperature readings have been plotted in Figure No. 10. For the months of August and September the aluminum foil coated tank showed the following average reduction in temperatures over the other tank.

Average difference in temperatures—		
Gas	7 a.m.	6.2°F.
Oil	7 a.m.	5.0°F.
Gas	5 p.m.	13.3°F.
Oil	5 p.m.	4.6°F.

It seems logical to anticipate a much greater life from these aluminum foil tank coatings than is obtained from paint coatings. This may be illustrated by a comparison of the foil coatings with an aluminum paint film. The great durability of aluminum paint films is generally recognized, as is also the fact that this durability is to be attributed to a thin film of aluminum which is formed by the "leafing" of the flakes of aluminum powder. This film of aluminum is only a few ten-thousandths of an inch in thickness. Even the thinnest aluminum foil coating which can be successfully applied will give a much greater protection than such a thin film. There seems to be little reason to fear rapid deterioration of the adhesive. Materials of a nature similar to that of the adhesives employed for foiling possess excellent durability when used in other ways. When used to cement foil, they are protected against air and sunlight, which are in most other applications responsible for their disintegration.

Use on Tank Cars

The same factors which make the foil coating so successful for large storage tanks have led to its use as a coating for tank cars. Here, where valuable refined products are handled, the reduction of evaporation losses will be even more important than in the case of most storage tanks. In addition to the durability and the reduction of evaporation, the striking appearance of foil coated tank cars is a reason in favor of the method. The same three reasons would seem to make the foil coating particularly applicable for use upon bulk storage tanks handling refined products.

The foil coatings were originally developed with the intention of applying them on the insides of tanks which are exposed to severe sulphide corrosion. Actual application of foil for this purpose has been held up by the difficulty of obtaining an oil proof material of suitable adhesive properties. In small scale experiments on tank interiors, in which the foil was applied with an adhesive which was not oil proof, a life more than twice as great as that of the best paint coatings was obtained. However, such a method of application is not practical for actual protective jobs, due to the danger of slight punctures of the foil. We have recently found two adhesives which are extremely oil proof and which possess fair adhesive properties. We are proceeding with large scale test applications using these adhesives and hope to have results from which we can estimate their value within the next few months.

On Pipe Lines

Another type of application which is purely experimental is the use of aluminum foil for the protection of pipe lines. It seems certain that the foil will protect any pipe line coating material against destruction by soil stress effects. However, there is an unanswered question as to the durability of such coatings. Aluminum, although it is resistant to soil corrosion under most conditions, is quite rapidly corroded in some soils. It is possible that even where it is corroded it will serve to protect the underlying coating for a considerable length of time. We have applied tests to pipe lines over all types of coatings, both in soils which will corrode the aluminum rapidly and in soils against which it will probably have a great resistance. The use of foil on pipe lines must be regarded at the present time as a pure experiment and we do not feel that any prediction of the probable outcome of this experiment is possible at the present time.

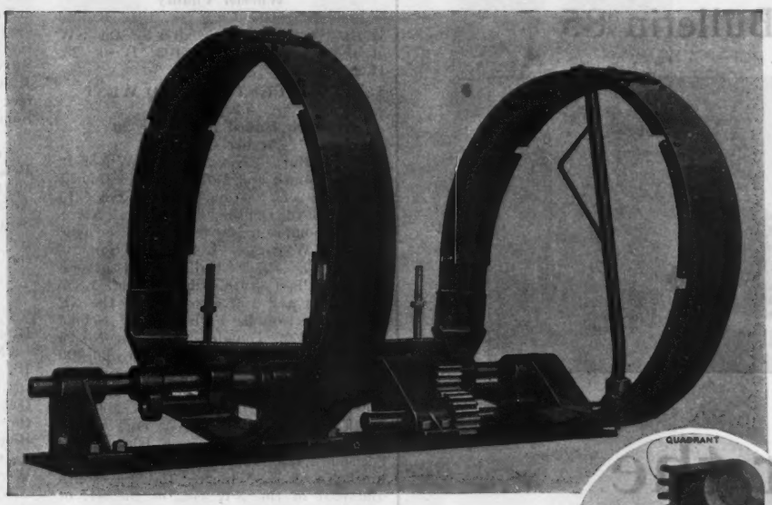
Interesting applications of foil applied by these methods are already being made in a number of industries. The process is so new that its true value cannot be estimated, but it seems certain that it will make economical the use of aluminum under many conditions for which considerations of cost have previously made it inapplicable.

RENAME PENNSYLVANIA SCHOOL

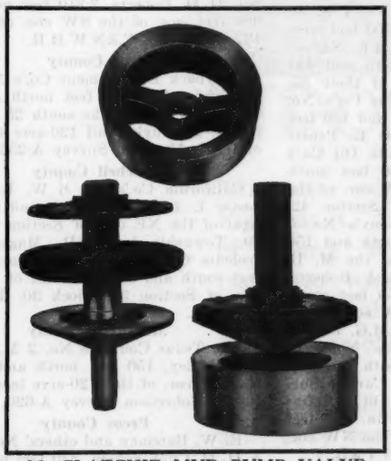
The trustees of Pennsylvania State College have renamed the School of Mines and Metallurgy as the School of Mineral Industries, President Ralph D. Hetzel announced.

Starting in 1891 as a Department of Mining, the School of Mineral Industries embraces every phase of the mineral industry, including mining, metallurgy, geology, mineralogy, geography, ceramics and oil and gas production. Expansion of all divisions of the School of Mineral Industries is expected with the completion next year of a new building for the school.

if companies gave Christmas bonuses based on efficiency



Rear view of the MacClatchie GEARED Brake for draw-works. The equalizer may be seen in the background. Insert at right shows the operation of the gears.



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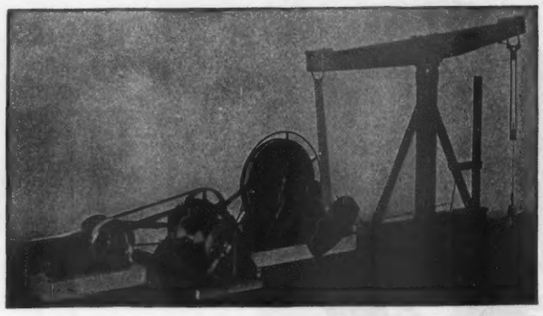

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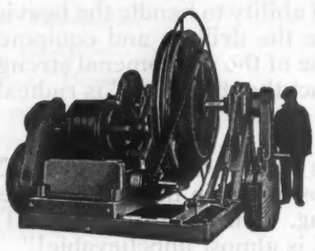

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Week Ended November 20
Gray County

Clayton-Key Oil Co.'s No. 1 E. Key, 330 feet north and east of the SW cor. of the east 42 acres of the north 84 acres of the south 168 acres of Section 1, B.&B. Shamrock Oil & Gas Co.'s No. 3 G. H. Saunders-Lincoln, 330 feet north and east of the SW cor. of the NE of Section 3, Block 1, A.C.H.&B. White Eagle Oil & Refining Co. and others' No. 3 S. Faulkner, 1,158 feet north and 330 feet east of the SW cor. of the east 80 acres of Section 29, Block B-2, H.&G.N.

Wheeler County

Lone Star Gas Co.'s No. 1 L. B. and H. S. Simms, at the center of the SW of the NE of Section 103, Block 23, H.&G.N.

NORTH CENTRAL AND WEST TEXAS
Week Ended November 20
Archer County

L. T. Burns' No. 3 L. F. Wilson-P, 650 feet south and 1,050 feet west of the NE cor. of Section 115, A.T.N.C.L. Gwynn-Boyd Drilling and others' No. 8 A. D. Thompson, 750 feet south and east of the NW cor. of Lot 16, Section 20, A.T.N.C.L. F. P. Cullum and others' No. 3 Falls County School Land, 1,885 feet north and 150 feet west of the SE cor. of Section 9, Falls County School Land, A-130. Douglas Oil Co.'s No. 5 W. J. McClure, 1,757 feet north and 490 feet east of the SW cor. of Section 13, Crawford Subdivision. W. R. Duke and others' No. 1 W. T. Richardson, 150 feet north and east of the SW cor. of the north 40 acres of the west 80 acres of Section 2,425, T.E.&L. Junker & Perkins' No. 1 B. Schlegel, 150 feet south and east of the NW cor. of the SE of the NW of Section 2, B.B.B.&C., A-899. Pandem Oil Corp.'s No. 1 J. A. Young-D-150 feet south and west of the NE cor. of the N half of the SE of Section 2,426, T.E.&L. Reeder and others' No. 6 A. M. Kunkel, 180 feet north and 366 feet west of the SE cor. of Section 3, B.B.B.&C., A-51.

Baylor County

Consolidated Oil Co. and others' No. 2 W. H. Portwood, 150 feet south and west of the NE cor. of the SE of Section 3,138, T.E.&L.

Brown County

Phillips Petroleum Co.'s No. 1 S. D. Stone, 660 feet south and 1,400 feet west of the NE cor. of the E.T.R.R. Survey No. 157, being 660 feet south and 441 feet west of the NE cor. of their 35-acre lease. Prairie Oil & Gas Co.'s No. 2 I. Shults, 1,050 feet south and 150 feet east of the NW cor. of the E. Pruett Survey No. 135. E. L. Smith Oil Co.'s No. 21 L. A. George, 1,450 feet north and 883 feet east of the SW cor. of the L. A. George tract out of Section 42, H.T.&B. The Texas Company's No. 5 W. S. Johnson, 750 feet north and 150 feet west of the SE cor. of the M. B. Nix Survey A-1,894. Bush & Roberts' No. 2 J. L. Richardson, 150 feet south and 950 feet east of the NW cor. of the south 80 acres of the S.A.&M.G. Survey A-1,233. Cranfill & Reynolds' No. 1 L. W. McDonald, 1,945 feet south and east of the SW cor. of the C. J. Carrier Survey No. 60, A-177. Humble Oil & Refining Co.'s No. 2 L. M. Martin, 800 feet south and 2,113 feet east of the NW cor. of the SW of Section 11, H.T.&B.

Clay County

Belcher and others' No. 7 H. C. Evans and others, 490 feet north and 320 feet west of the SE cor. of the SW of Section 6, Parker County School Land, A-374. J. F. Mayfield and others' No. 1 A. O. Mason, 150 feet south and west of the NE cor. of Section 30, Madison County School Land, A-302. J. F. Merrick and others' No. 2 G. W. Byers & Co., 1,467 feet south and 150 feet west of the NE cor. of Section 15, Byers Brothers Subdivision. Saxet Oil Co.'s No. 1 B. Landrum, 150 feet south and west of the NE cor. of Lot 9, Landrum Subdivision, Section 3, Parker County School Land, A-374.

Coleman County

Mitchel & Groves and others' No. 1 C. M. Wilkerson, 200 feet south and east of the most westerly NW cor. of the C. M. Wilkerson 178-acre tract out of the John Wiley Survey No. 720. J. McCamey and others' No. 3 Sealy & Smith, 960 feet south and 5,250 feet east of the most westerly NW cor. of Section 35, Block 1, G.H.&H. H. Samuels' No. 3 J. A. Robertson, 470 feet north and 2,100 feet west of the SE cor. of the J. A. Robertson 289.5-acre tract out of the E. Votaw Survey No. 224. Simpson-White & Pinkerton's No. 1 J. W. Wells, 400 feet south and east of the NW cor. of Section 15, North Subdivision, M. Martinez Survey No. 751. J. W. Wilmot's No. 1 J. K. Baker, 1,950 feet north and 1,450 feet east of the SW cor. of the M. Hunt Survey No. 275.

Cooke County

Camp Oil & Gas Co.'s No. 1 Mrs. A. Belz, 150 feet north and 2,838 feet west of the SE cor. of the J. R. Davis Survey A-334. Danciger Oil & Refining Co. & Staniforth's No. 1 N. E. Ramsey, 150 feet north and east of the SW cor. of the N. E. Ramsey 80-acre tract out of the B. Lusk Survey A-569.

Crane County

C. C. Duffey and others' No. 7 Cowden Brothers & Co., 1,320 feet north and 1,420 feet west of the SE cor. of Section 18, Block X, C.C.S.D.&R.G.N.G. Tidal Oil Co.'s No. 3 University Land-E, 330 feet north and east of the SW cor. of the E half of the NW of Section 39, Block 30, University Land. Warner-Quinlan Co.'s No. 6 University (Church-Weekley), 330 feet south and east of the NW cor. of the E half of the SW of Section 39, Block 30, University Land.

Crockett County

Magnolia Petroleum Co.'s No. 1 A. C. Hoover, 2,310 feet north and 330 feet west of the SE cor. of Section 12, Block 1, G.C.&S.F.

Howard County

Empire Gas & Fuel Co.'s No. 4 H. R. Clay, 330 feet north and 2,310 feet west of the SE cor. of Section 127, Blk. 29, W.&N.W.R.R. Godley Oil Co.'s No. 17 A. J. Hooks, 1,980 feet south and 2,440 feet east of the NW cor. of Section 140, Block 29, W.&N.W.R.R. Ward Oil Co.'s No. 21 D. Roberts, 2,310 feet north and 990 feet east of the SW cor. of Section 137, Block 29, W.&N.W.R.R.

Jack County

Grayback Development Co.'s No. 1 A. B. Kuykendall, 330 feet north and east of the SW cor. of the south 25 acres of the A. B. Kuykendall 120-acre tract out of the I. Hughson Survey A-256.

Mitchell County

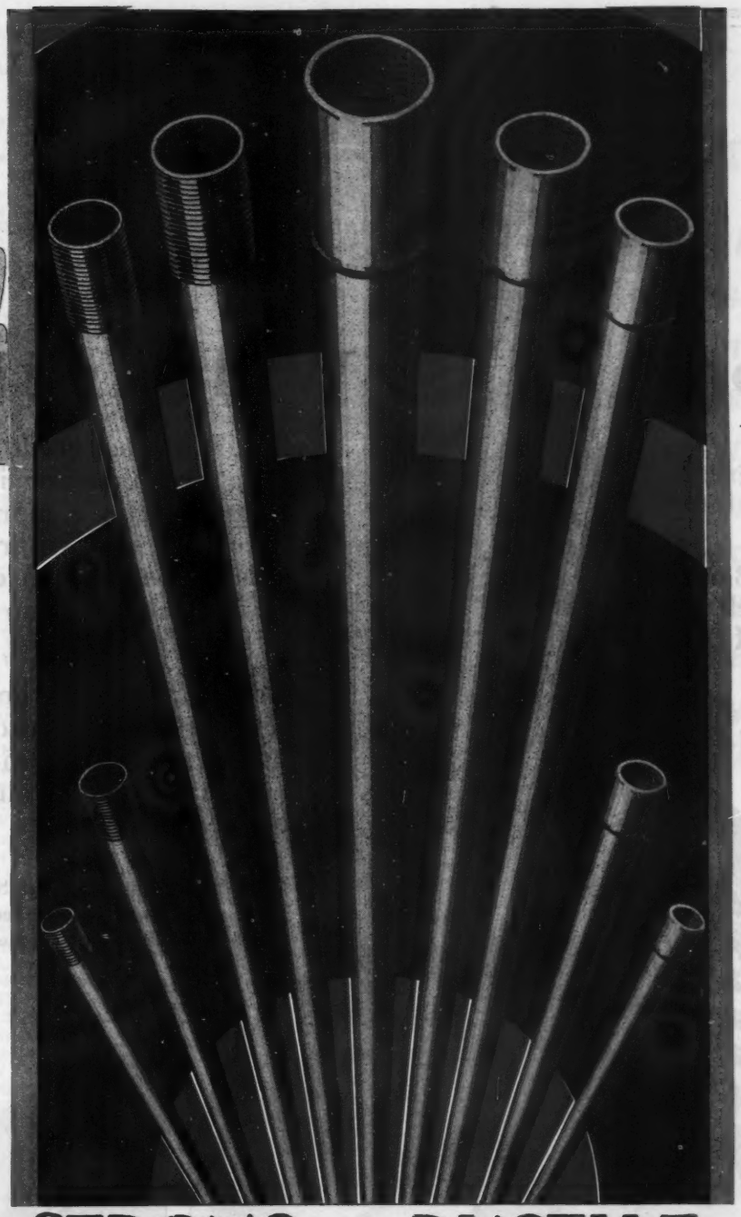
California Co.'s No. 8 W. L. Foster, Lease 1, 1,100 feet south and 990 feet west of the NE cor. of Section 6, Block 29, Township 1s, T.&P. Magnolia Petroleum Co.'s No. 1 D. H. Snyder, 330 feet south and 990 feet east of the NW cor. of Section 36, Block 30, Township 1s, T.&P.

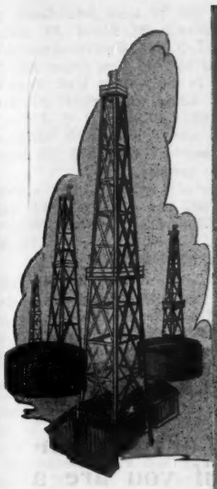
Montague County

The Texas County's No. 2 M. H. Salmon-Henley, 150 feet north and east of the SW cor. of their 20-acre lease out of the F. Robertson Survey A-620.

Pecos County

E. W. Bateman and others' No. 1 J. C. & D. H. Cunningham, 330 feet north and east of the SW cor. of the NE of Section 34, Block 11, H.&G.N. Buell & Hagan's No. 1 L. L. Byrne, 990 feet southeast of the northwest line and 2,310 feet southwest of the northeast line of Section 54, Block 10, H.&G.N. Cosby Production & Royalty Co.'s No. 3 Mrs. M. A. Smith, 330 feet north and east of the SW cor. of their lease out of Section 24, Block 194, C.C.&S.F. Landreth Production Corp.'s No. 4 University Land-A, 990 feet south and 330 feet east of the NW cor. of the E half of the SE of Section 13, Block 18, University Land. Same corporation's No. 5 University-A, 330





STRONG yet DUCTILE,

No matter what you consider important in pipe, Spang Pipe has it. Take strength, for example. Every length of "Spang" Welded and "Standard" Seamless Pipe is tested to withstand pressures higher than you will ever subject them in service—That means the maximum factor of safety for any emergency.

Another thing you will like about Spang Pipe is the soft, easy working quality of the special steel—saves time and labor.

WELDED

CASING
STANDARD PIPE
LARGE O. D. PIPE
LINE PIPE
DRIVE PIPE
DRILL PIPE

Sizes ⅛ inch to 24 inch O. D.

SEAMLESS

CASING
TUBING
DRILL PIPE
(Regular and Heat Treated)
LINE PIPE
STILL TUBES

Sizes 2 inch to 13⅜ inch O. D.

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SPANG, CHALFANT & CO., INC.

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Oil is a World Wide Industry

Within the short span of less than an average life, this great source of power has grown into world importance.

The Exchange National Bank of Tulsa was organized back in 1910 to care for the needs of the then infant industry.

Keeping pace, it now lists as patrons thousands of individuals and firms in every branch of the industry and in every corner of the petroleum globe.

If your firm has credit or merchandising problems—or if you are a producer, refiner, marketer, a royalty owner, or own prospective oil lands, there is experience, service and helpful advice to be found in this organization.

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Combined Capital, Surplus and Undivided Profits Exceed $10,000,000; Resources Exceed $100,000,000.

EXCHANGE BANKS OF TULSA

The Exchange National Bank — Exchange Trust Company

feet north and west of the SE cor. of Section 13, Block 18, University Land. Same corporation's No. 6 University-A, 330 feet north and east of the SW cor. of the E half of the SE of Section 13, Block 18, University Land. World Oil Co.'s No. 2 University, 330 feet south and 2,310 feet west of the NE cor. of Section 31, Block 16, University Land.

Upton County

Texon Oil & Land Co.'s No. 2 M. Shirk, 430 feet south and 330 feet east of the NW cor. of Section 35, Block 1, M.K.&T.

Ward County

Gulf Production Co.'s No. 3 Hutchings Stock Association, 330 feet north and east of the SW cor. of the NW of Section 1, Block F, Gunter & Munson, Maddox Brothers & Anderson Survey.

Wilbarger County

L. G. Bradstreet Co.'s No. 5 W. T. Waggoner-C, 961 feet north and 1,371 feet west of the SE cor. of its lease "C" out of Section 31, Block 4, H.&T.C. L. G. Bradstreet Co.'s No. 1 W. T. Waggoner-G, 205 feet south and west of the NE cor. of the SW of the SE of Section 17, Block 5, H.&T.C. Cosden Oil Co.'s No. 5 W. T. Waggoner-D, 1,461 feet south and 1,050 feet west of the NE cor. of Section 35, Block 2, H.&T.C. Empire Gas & Fuel Co.'s No. 19 W. T. Waggoner-A, 298 feet north and 885 feet west of the SE cor. of the NW of Section 32, Block 4, H.&T.C. Empire Gas & Fuel Co.'s No. 26 W. T. Waggoner-B, 270 feet south and 920 feet west of the NE cor. of the SW of Section 32, Block 4, H.&T.C. Same company's No. 27 Waggoner-B, 560 feet north and 674 feet west of the SE cor. of the NE of the SW of Section 32, Block 4, H.&T.C. Same company's No. 28 Waggoner-B, 1,262 feet north and 205 feet east of the SW cor. of the NW of the SW of Section 32, Block 4, H.&T.C. Staley-Wynne & Co.'s No. 7 W. T. Waggoner-E, 205 feet south and 255 feet west of the NE cor. of the SW of the NE of Section 25, Block 4, H.&T.C. Same company's No. 8 Waggoner-E, 205 feet north and east of the SW cor. of the SW of the NE of Section 25, Block 4, H.&T.C. Same company's No. 4 Waggoner-S, 660 feet south and 205 feet west of the NE cor. of the SE of the SW of Section 25, Block 4, H.&T.C. Waggoner Refining Co.'s No. 3 Waggoner-P, 750 feet south and 1,330 feet west of the NE cor. of Section 35, Block 2, H.&T.C. Waggoner Refining Co.'s No. 4 Waggoner--P, 1,050 feet south and 1,330 feet west of the NE cor. of Section 35, Block 2, H.&T.C.

Winkler County

M. J. Bashara's No. 2 M. J. Bashara, 990 feet north and 2,310 feet west of the SE cor. of Section 17, Block B-3, School Land.

Young County

Perkins & Cullum's No. 1 E. Deitrich, 150 feet south and east of the NW cor. of the west 45 acres of the north 75 acres of the E. Deitrich 145-acre tract out of the G. W. Stell Survey A-256. Richardson Oil Corp.'s No. 2 J. W. Dean, 450 feet north and east of the SW cor. of the NE of Section 19, Young County School Land, A-1,284. Riggs & Williams' No. 1 A. B. Vanmeter, 150 feet north and west of the SE cor. of the north 40 acres of the E half of Section 177, T.E.&L. Sun Oil Co.'s No. 15 O. Deitrich, 750 feet south and 150 feet west of the NE cor. of its 114-acre lease out of Section 4, B.B.B.&C., A-1,700. Wise & Jackson's No. 5 F. M. Cullers, 150 feet north and 780 feet west of the SE cor. of the NW of the SE of Section 2, C.T.R.R. D. L. Wolf's No. 2 R. E. Hill, 1,103 feet south and 1,850 feet west of the NE cor. of Section 195, T.E.&L. Wooten & Reed's No. 1 A. C. Casey, 150 feet north and 345 feet east of the SW cor. of the A. C. Casey Survey A-7,076.

Corrections

In Brown County: Ven-Mex Oil Co.'s No. 1 G. T. Butler, 150 feet north and west of the SE cor. of the east 44 acres of the west 94 acres of the south 144 acres of the G. T. Butler 300-acre tract out of the J. McGloin Survey No. 798, A-1,499.

In Gray County: Robertson & Devore's No. 1 J. M. Saunders, 315 feet north and 330 feet east of the SW cor. of the E half of the NW of Section 40, Block 3, I.&G.N. The Texas Company's No. 7 Cook-Faulkner, 330 feet north and west of the SE cor. of the west 1,722 acres of Section 29, Block B-2, H.&G.N. White Eagle Oil & Refining Co. and others' No. 2 S. Faulkner, 330 feet north and east of the SW cor. of the east 80 acres of Section 29, Block B-2, H.&G.N.

MANY CHANGES MADE IN STATION OPERATION

(Continued from Page 234)

operating two stations, and the Banner Oil Co. at Ogden, operating 11 stations. K. V. Clifford is district manager with headquarters at Salt Lake City. The Shell products have been marketed in Denver for some time by the Navy Gas & Supply Co. and an aggressive campaign for new business has been conducted. It is reported that the company expects to open its own divisional offices here and continue enlarging its outlets. Its Utah program called for an expenditure of $300,000 in 60 days in establishing service stations, warehouses and offices.

The Continental Oil Co. is introducing a new brand of motor oils and greases to take the place of the brands formerly marketed in this territory. These will be known as the Conoco Germ Processed Motor Oils. The Germ process is a patented method developed by Henry M. Wells and J. E. Southcombe, two British scientists.

SUBSTANTIAL GAIN IN WESTERN STATES

(Continued from Page 234)

throughout the South Central area and into portions of the Rocky Mountain area. Deliveries of fuel oil to firms engaged in general manufacturing in the South Central area decreased from 7,644,000 bbls. in 1926 to 4,483,000 bbls. in 1928. From such indications as are available, it is indicated that natural gas has been substituted to a certain extent for fuel oil by manufacturing plants in the area adjacent to the natural gas fields of the Gulf Coast and Mid-Continent areas.

Railroad Demand

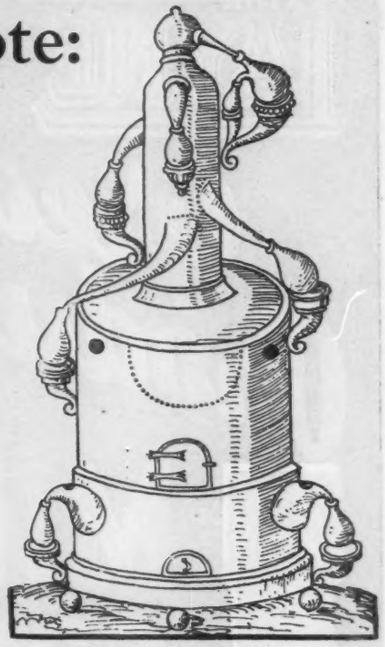
Railroads which obtain their fuel oil supply in the Central United States purchased 38,824,000 bbls. of oil, a gain of 484,000 bbls., or 1.3 per cent, over the 1927 requirements. Railroads in the North Central and South Central areas showed increases of 295,000 bbls. and 4,092,000 bbls., respectively, in their fuel oil purchases, while railroads in the Rocky Mountain area bought 903,000 bbls. less than in the previous year. Deliveries of bunker oil required 16,812,000 bbls., as against 18,001,000 bbls. in 1927. The bulk of these deliveries, 99.1 per cent, went to vessels operating from Gulf Coast ports, and the remainder to river and lake steamers. Companies supplying manufactured gas and electric power in the Central United States purchased 6,781,000 bbls. of gas oil and fuel oil in 1928, an increase of 4.3 per cent above the 1927 requirements of 6,502,000 bbls.

Figures compiled by the United States Geological Survey indicate that the quantity of fuel oil burned in the generation of electric power within this area increased from 1,953,000 bbls. in 1927 to 2,326,000 bbls. in 1928, while natural gas consumption in the generation of electric power within the area increased from 55,494,847,000 feet in 1927 to 64,195,555,000 feet.

The various industries engaged in manufacturing in the Central United States required 9,568,000 bbls. in 1928 as compared with 11,663,000 bbls. in 1927, a decrease of 17.8 per cent. The chemical, automotive, textile, logging and lumbering industries used more fuel oil in 1928 than in 1927, while smaller deliveries were made to paper and wood pulp manufacturers, cement and lime plants, and to the ceramic and food industries. It is probable that the decline in deliveries to this latter group of manufacturers

in 1553 the alchemist Porta wrote:

"Now we speak of oyles. These require the industry of a most ingenious artifycer, for many of the most excellent essences of things do remain in the oyl so that without



(Libavius, *Alchymia*, Frankfurt, 1606)

the greatest art, wit, cunning and pains they cannot be brought to light, so that the whole art of distillation dependeth on this"

and in 1929

it is equally true

The Walter E. Lummus Co.

Petroleum Refinery Construction

148 State St., Boston, Mass.

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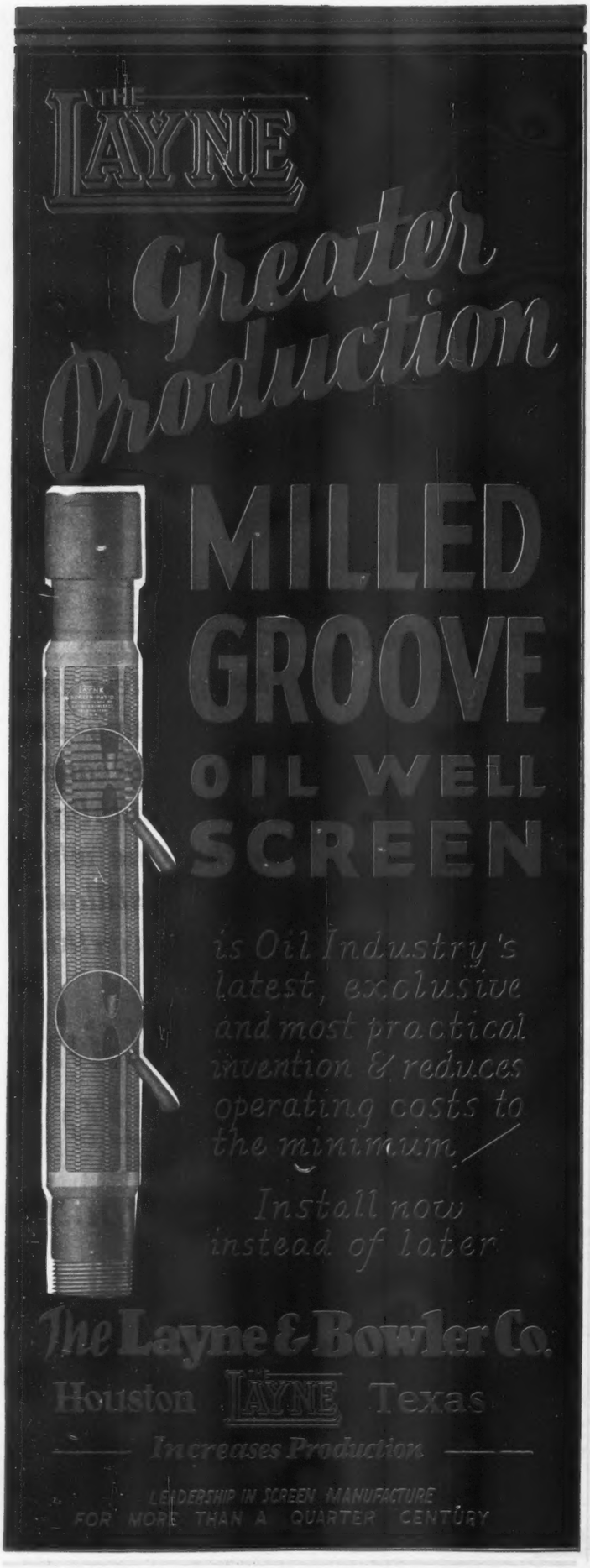


may be accounted for to a large extent by the substitution of natural gas for oil as a fuel.

Information pertaining to the manufacture of cement in this area shows a considerable decrease in fuel oil requirements and a corresponding increase in the demand for natural gas. In the Rocky Mountain States, manufacturers used more fuel oil in 1928 than in 1927, while losses were recorded in the North Central and South Central areas. The totals for the northern group were 5,256,000 bbls. in 1927 and 4,896,000 bbls. in 1928, and for the southern group, were 6,240,000 bbls. in 1927 and 4,483,000 bbls. in 1928.

Refinery Use

One of the principal increases in the consumption of fuel oil is that reported by the oil companies in connection with their use of oil as a fuel in field, pipeline, and refinery operations. The 1928 consumption of 27,766,000 bbls. for this purpose was 17.9 per cent larger than the 23,559,000 bbls. used in 1927. The greatest proportionate increase in the consumption of fuel oil by the petroleum industry was in the North Central States, where 7,112,000 bbls. were burned in 1928, an increase of 26.8 per cent over the 1927 consumption. In the South Central States the increase was 16.2 per cent, and in the Rocky Mountain area petroleum companies required 6.1 per cent more fuel in 1928 for their field and refinery operations than in 1927.

The severity of the weather and the long periods of cold during the past winter, combined with an increased number of oil-burner installations, resulted in important increases in the demand for oil for domestic and commercial heating. The demand for gas oil and fuel oil in the heating of buildings in the Central United States totaled 9,375,000 bbls. in 1928, a quantity 28.9 per cent larger than the 1927 requirements. This total does not include furnace oil and distillates used to a large extent in the heating of residences, but it is estimated that the 1928 requirement for these oils was approximately 5,500,000 bbls. This quantity added to that reported for gas oil and fuel oil deliveries indicates that the total demand for oils in commercial and domestic heating in the Central United States during 1928 was 14,875,000 bbls., as compared with 11,274,000 bbls. in 1927 and 8,831,000 bbls. in 1926.

Further details are given in Information Circular 6204, copies of which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

OIL ROADS ARE GIVING SATISFACTORY SERVICE

(Continued from Page 234)

an oiled road in good condition permanently.

More Maintenance

It should be fully understood that an oiled road requires more maintenance than either concrete or asphalt, at least more than the latter types do for the first few years. In the above calculations no allowance has been made for maintenance on concrete or asphalt roads. The crux of the whole question of road building in Wyoming is to secure a good road as quickly as possible at a cost that can be borne by the taxpayers.

For oiled roads such as we have just discussed no other base than the traffic compacted earth is used. We have already mentioned the fact that the edges of the road continue to be soft even after two or more years of use.

In the more expensive types of construction, such as asphalt and concrete, an artificial base is used which partially overcomes this weakness, but as already stated the cost is prohibitive. Now if we had a permanent surface and a base having soft edges considerable repairs to the edges of the road would be necessary from time to time. Therefore a permanent surface is of no great advantage where earth is used as a base.

A road of the oiled type, if properly constructed, needs only minor repairs at the end of one year. Most of these repairs are needed on the edges of the roads. Now and then a chuck hole may appear in the middle of the road due to faulty mixing. These small repairs are made by hand, using a prepared mixture of coarse sand and oil. It is necessary to dig out the hole so as to leave square (vertical) edges to prevent the patch from being pushed out.

In some instances, particularly where too coarse gravel was used or where the mixture was too lean, the road at the end of one year may be slightly pockmarked. Such a road is about as comfortable for driving as a perfect one, nevertheless, if the road is pockmarked it will go to pieces unless it receives prompt attention. Water will collect in the small holes and freeze, also some coarse gravel will be pulled loose on the edge of thes pockmarks by car wheels. This condition can be remedied very cheaply. A surface coat of the same quality road oil as that used in the original construction is applied to one-half of the road at a time. This is allowed 16 to 24 hours to penetrate as far as it will and is then covered with a very light coat of sand. Nothing further is required. This is known as flush coating.

Repairing Roads

If the original construction was not right, or if the road did not receive the necessary small repairs mentioned above the first year, it may be necessary to scarify the entire surface of the road after two years' use. Usually, however, the repairs the second year need only be of the same nature as those already described. In general, at the end of about three years it seems quite certain that it will be necessary to rescarify the surface of the road. If sufficient gravel was used in the original construction no more is now necessary. Usually a very small amount of road oil will be added after the road is scarified. Sometimes no road oil is necessary, only scarification. In any case after scarifying, the road material is thoroughly mixed much as in the first instance though considerable less labor is required. As before the surface is bladed, leaving a small crown and then opened to traffic.

We have no roads of this type inWyoming more than about three years old, so we can only conjecture any repairs necessary in future years; but it is the opinion of those most familiar with the work that the repairs in future years will not be greater than for the first three, say an average year in and year out of $400 per mile.

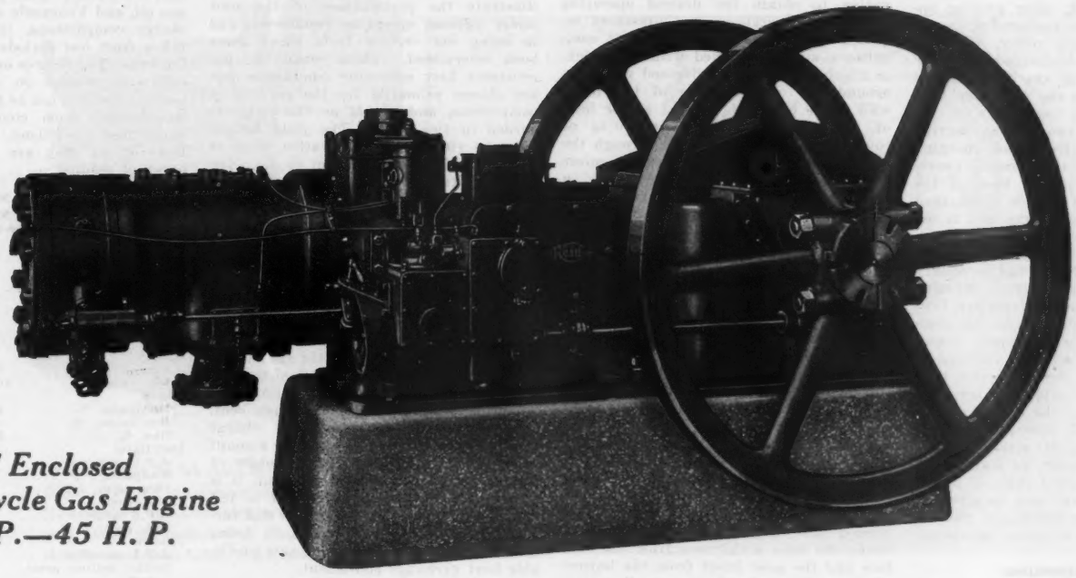
It is to be noted here that ease of rescarification and ability to mix thoroughly the old material after two or three years is essential to this method of maintenance. If the surface becomes very hard like an asphalt road it would pull up in cakes when scarified and could not be mixed and bladed properly. In other words the road would have to be rebuilt. Experience shows that when the type of road oil which is now specified by the Wyoming Highway Department is used no trouble is encountered in this work. The surface is readily scarified and mixes as easily as it did originally and can just as readily be bladed to a smooth surface.

Binding Power

There is a popular idea that great binding power is necessary to hold together a road metal in the road surface. This we believe to be wrong. It is well known that given a proper moisture content no better road can be desired than may be built of sand and clay. Of course such a sand and clay road goes to pieces in very wet weather and does not hold up as well as it should in long dry spells, but it gives a practically perfect surface when containing the right amount of moisture. Now certainly this type of road (sand and clay) is not strongly bound. However, it withstands traffic well. This I think is sufficient evidence that a very strong cement or binder is not necessary but rather a cement or binder of moderate strength which retains its plasticity as long as possible.

In fact it seems quite obvious for this type of road that we do not wish an oil which hardens or drys, but rather one which acts as a plastic binder and which may be rescarified whenever necessary.

REID



Type C Enclosed
Two Cycle Gas Engine
40 H. P.—45 H. P.

With Pressure Oiling System— A New Reid Feature

A pressure oiling system, which is supplementary to the splash system, has been designed for the Type C Two Cycle Gas Engine.

The pressure system delivers oil under pressure to the main bearings, crank pin, and cross-head pin. The oil being forced between the bearing surfaces insures perfect lubrication and prolongs the life of the bearings.

The use of the pressure system allows heavier loads to be carried over longer limits of time, and permits overloads on the reciprocating parts that could not be carried safely with splash oiling alone.

Ask any representative or at any branch or agency for the complete details of this oiling system.

JOSEPH REID GAS ENGINE COMPANY
OIL CITY, PENNSYLVANIA, U. S. A.

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OIL FIELD MACHINERY

DESCRIBE NEW TYPE OF CRACKING UNIT

(Continued from Page 132)

and recycle stock fractionating column, a secondary tower providing a cycle stock accumulator and a gasoline fractionating column, a condenser, a gas separator, and an absorption tower for the recovery of gasoline from the gas, together with such supplementary equipment, in the form of heat exchangers and reflux condensers, as may be necessary for efficient operation.

The charging stock, after passing optionally through heat exchangers, is admitted to the primary tower, where it meets the products discharged from the heater. The resulting cracking distillation throws over into the secondary tower the recycle stock together with the gasoline vapors and process gas, leaving the heavy bottoms from the charging stock in the base of the primary tower. From the reservoir in the base of the secondary tower, the recycle stock then passes to a circulating pump and is delivered, at high pressure, from the circulating line to the heating element.

Control in both primary and secondary towers is effected by reflux, utilizing cooled recycle stock for the primary tower and cracked distillate from the gasoline condenser for the secondary tower. The process gas released from the separator is passed through the absorption tower, where the gasoline values are scrubbed out with a portion of the cooled recycle stock. The enriched absorption oil is then utilized as reflux for either the primary or secondary tower, as may be desired. It is to be noted that, if necessary, additional preheat may be given to the charging stock by utilizing a portion of the heater surface before admission to the primary tower.

Practical Operation

The practical operation of the unit is largely dependent on the control and the handling of the cycle stock to the heater and the separation of the vapors and liquids in the base of the mixing chamber. The quality of the cycle stock is maintained within definite limits by fractionation through bubble trays against a positive gas oil reflux and continuously observed in a sight glass placed on the control board. It has been found that its color can be relied upon to indicate its carbon forming properties which, coupled with its gravity, constitute a simple method of determining its character. It is drawn from the fractionator in a liquid state at a temperature of between 500° and 600° F., subjected to whatever pressure may be desired to force it through the heater, and then accurately measured through an orifice meter which permits control of its flow. By utilizing comparatively high pressure drops, of the order of 300 pounds per square inch, it is possible to pass it through the heater at very high velocity, which not only permits efficient heat transfer, but avoids any possibility of local heat or parasitic cracking on the walls of the tubes leading to carbon deposit, particularly at high temperatures. The combination of eliminating material which might deposit upon vaporization, and the employment of high velocity, permit the heater to operate for indefinite periods without cleaning.

The incoming vapors from the coil, containing in some cases entrained droplets of tar, are brought into intimate contact with the liquid in the base of the tower, where heat interchange and tar separation without entrainment is obtained by centrifugal action. The centrifugal effect is obtained by admitting the heater discharge through a nozzle tangent to the walls of the chamber, setting up a rotation of both liquid and vapor which not only facilitates separation but actually creates more disengaging surface by giving the liquid a concave form. An efficient separation at this point is extremely important, as the formation of carbon in the bubble trays would seriously reduce the operating time. The positive nature of this separation is evidenced by samples, drawn from the center of the mixing chamber beneath the bubble trays, and which are found to consist of translucent gas oil regardless of the character of charging stock processed. This arrangement not only permits the use of a smaller separating space, but avoids the possibility of forming carbon due to alternate wetting and drying of surfaces; likewise, it induces efficient heat transfer, permitting a higher temperature to be carried at the bottom without coke deposit, which is further inhibited by constant agitation.

Design of Heating Element

The design of the heating element is of outstanding importance in the combination to obtain the desired operating range of temperatures and pressures required of the unit. This element comprises a steel shell lined with fire brick, in which the tubes are disposed vertically around the circumference of the inner wall. The burner is located at the base of the structure, causing products of combustion to travel upward through the radiant chamber, through the economizer section, passing between the tubes in this section and thence through the superimposed air preheater to the stack. The air for combustion travels around the fire tubes of the air preheater and thence to the burner, which subsequently increases the temperature of combustion. The heat transfer to the oil tubes is effected mainly by radiation, which insures maximum heat transfer at all points under all firing conditions. The small economizer section acts also as a screen for the protection of the tube sheet of the air preheater. In all cases combustion conditions, with practically no excess air, are maintained, and the flame burst temperatures are carried as high as possible. It is practicable to do this, since the heat absorbing surface is so proportioned to the amount of fuel burned that a balance is obtained between the heat withdrawn from the surface and the heat input from the burner which permits only the tube walls to attain a chosen maximum temperature. In other words, the oil which is being pumped through the tubes absorbs heat at such a rate that a high differential is maintained between absorbing surface and the flame proper. There is no tendency for even an intense flame to overheat any one tube, since in this case all of the tubes are equally spaced at a safe distance from the flame and perform substantially the same duty. At any duty less than the maximum for which the heater is designed, resulting tube temperatures will be reduced well below those permissible.

This type of heating unit has the advantage that it makes possible the heating of the oil to high temperatures economically without overloading any one portion of the heating surface. Furthermore, the reduction of free oxygen in the combustion gases to a minimum prevents oxidation of the outer tube surfaces. By disposing the tubes vertically, the possibility of sagging is eliminated. The heater has structurally interesting advantages, which need not be discussed in this paper.

Responsive to Control

The unit, as a whole, is remarkably responsive to control, and once stabilized does not exhibit any tendency to become unbalanced. It can be actually put on stream within two hours of firing and is capable of long periods of continuous operation. An examination of the equipment after 600 or 700 stream hours indicates that much longer runs are possible, although at present it is the practice to limit their duration for the purpose of inspection. Adjustments for variation of charge are simple, and it has been found that the presence of water in the charge causes relatively little disturbance in the system.

Perhaps it should be mentioned that the controls of the unit are entirely centralized on one board, and that the operation can be carried out by a single operator, although two are usually employed per shift for the sake of safety and to obtain data which is constantly required for general information.

It will be evident that space does not permit recounting in detail many of the interesting results obtained during the course of this work, and that constant experimenting with operating combinations will furnish new and valuable data in a manner which appears at present unending. Neither is it possible to discuss numerous features whose combinations have been found to be vital to success. It may be said, however, that future work does not contemplate change in equipment which has proven itself beyond question and represents today a new tool, the varied uses of which will expand gradually.

Various Operating Conditions

The following results are presented to illustrate the performance of the unit under various operating conditions, and to bring out certain facts which have been determined. These results do not represent best operating conditions, but are chosen primarily for the purpose of comparison, and should be distinctly regarded in this light. The yield figures must be viewed as conservative, since it is known that two per cent to four per cent additional gasoline yield can be obtained by adequate stripping of the gas.

Fuel consumption for the unit varies mostly with the character of the oil charged, particularly since it is based on fresh oil charged to the plant. In the case of Venezuela crude, the overall figure for fuel has averaged between five per cent and six per cent of the oil charged, and includes both the gas burned and the small amount of oil fuel used in starting up. On gas oil the fuel consumption is of the order of 12 per cent, which appears higher on the charge basis; but, in view of the greater amount of processing and yields of the order of 60 per cent instead of 30 per cent, it is about as might be expected. It is felt that the fuel consumption can be still further improved, and provision is being made in new designs to incorporate profitable heat exchange equipment.

Performance of Unit

Table 1 illustrates the performance of the unit on three runs of approximately the same quantity of charge, under high temperature and different pressures. Run 25 was made at a temperature of 1,071° F., and a heater outlet pressure of 21 pounds, while runs 29 and 35 were made with slightly lower temperatures and an average pressure of about 80 pounds.

Comparing the runs, it will be noted that increase in pressure has increased the yield of distillate and improved its quality, particularly with respect to color and treating properties. The production of residuum has been materially decreased and, at the same time, the viscosity has been improved and the gravity reduced.

Mention should be made of the increase of gas in the high pressure runs, which is directly due to more intense cracking and cannot be taken as a dependent effect of pressure. The charge stock in all three runs was the usual grade of Venezuela crude, which varies from 19.2° to 20.5° A.P.I. The crude varies somewhat in gasoline content, as is shown by the percentage of straightrun and cracked gasoline in the distillate. Run 35 has been operated to produce a lower endpoint distillate, which accounts for the difference in distillate yield figures from run 29.

Experience obtained on the relative merits of running at 80 pounds, and pressures of the order of one atmosphere, clearly indicates that better operating conditions are obtained at the higher pressures with regard to the increase in distillate produced, the decrease and improvement of residuum, and better quality of distillates. These considerations, combined with the fact that the antiknock properties of the distillates have not been reduced with the increase of pressure, has led to setting aside low pressure operation at least for the present.

Comparison of Runs

Table 2 shows the performance of the unit on Pennsylvania gas oil, California gas oil, and Venezuela crude. In order to obtain comparisons, these figures were taken from test periods of operation during runs. The figures on gas oil represent composite results on various operating periods, and are not as favorable as might be expected from continuous operation under best conditions. They are useful, however, as they are indicative of the order of results.

TABLE NO. 3
COMPARISON OF RUNS AT TEMPERATURES 1,050-1,100° F.

	Pennsylvania gas oil 80 lbs. pressure	California gas oil 80 lbs. pressure	Venezuela crude* 80 lbs. pressure
Charge:			
Barrel	1,070	1,631	1,345
Per cent	100.00	100.00	100.00
Yields:			
Distillate, %	61.40	53.89	36.40
Residuum, %	7.90	18.70	56.00
Gas, %	29.20	26.97	6.10
Distillate:			
A.P.I. gravity	59.5	55.5	55.4
Endpoint, ° F.	416	412	403
50% point, ° F.	253	283	282
Circulation:			
A.P.I. gravity	34.6	28.1	26.3
50% point, ° F.	509	502	514
Charge:			
A.P.I. gravity	40.0	32.4	20.1
Initial boiling point, ° F.	430	456	149
Per cent over at 392° F.	None	None	8.00
50% point, ° F.	546	516	...
Residuum:			
A.P.I. gravity	7.6	7.2	9.3
Viscosity furol at 122° F.	280	280	165

*Period taken between 500th and 550th hour of operation.

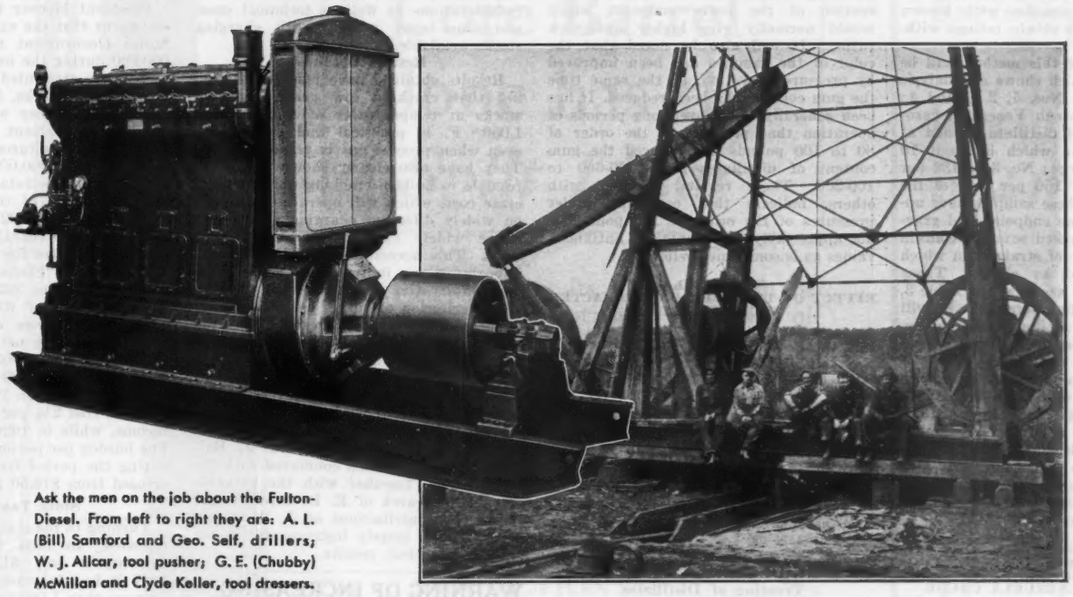
Both Pennsylvania and California gas oil have been run to coke by returning the bottoms to the charging stock, and under these conditions it was found that yields of distillate could be increased but that gas yields rose out of proportion to the additional amount of distillate made as the bottoms became reduced to coke.

TABLE NO. 1
COMPARISON OF VENEZUELA CRUDE NONPRESSURE AND PRESSURE

	Run 25 Venezuela crude		Run 29 Venezuela crude		Run 35 Venezuela crude
Stream hours	400		607		719
Temperature, deg. F. (heater outlet)	1,071		1,046		1,021
Pressure, lb.	21		78		78
Charge, bbl.	19,422		20,124		19,804
Charge, per cent	100.00		100.00		100.00
Yield					
Distillate, per cent	23.71		32.02		26.10
Straight run	7.00	6.00		5.75	
Cracked	16.71	26.02		20.35	
Residuum, per cent	69.07		58.64		62.70
Gas, per cent	6.39		10.16		10.60
Tests					
Charge					
A.P.I. gravity	19.2		20.5		19.0
Distillate					
A.P.I. gravity	54.5		56.7		56.6
Endpoint, deg. F.	393		392		364
Color (Saybolt)	Yellow		—2		+1
Residuum					
A.P.I. gravity	11.2		10.0		9.9
Viscosity furol at 122° F.	703		297		326

Antiknock Properties

Perhaps the characteristic of greatest interest in high temperature distillates lies in their antiknock properties, and constitutes one of the chief reasons for operating in this range of temperature. It is generally found that the antiknock values of distillates increase with operating temperatures. The increase is very rapid up to a certain point, and then less marked. Since the increase in operating temperatures is usually attended by an increase in process gas, the antiknock values are sometimes associated directly with increased gas production. It has been found that such is not necessarily the case; and, whereas the production of gas



Ask the men on the job about the Fulton-Diesel. From left to right they are: A. L. (Bill) Samford and Geo. Self, drillers; W. J. Allcar, tool pusher; G. E. (Chubby) McMillan and Clyde Keller, tool dressers.

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may increase indefinitely, the antiknock values do not.

One of the difficulties of experimenting with antiknock values lies in the difficulty of obtaining accurate ratings for distillates. For the purpose of this work, the antiknock ratings have been obtained mostly by The Texas Company rating. In this scale, Pennsylvania gasoline is rated zero and commercial antiknock gasolines about 25. It has been our experience that these ratings were more comparable between 20 and 30, and it has been the practice to dilute samples with known mixtures in order to obtain ratings within these limits.

An illustration of this method will be seen in Table 3, which shows an analysis of the blend stocks Nos. 1, 2, 3 and 4; No. 1 being straightrun Venezuela gasoline; No. 2 cracked distillate formed at the normal gas rate which is about 10 per cent of the charge; No. 3 at 132 per cent, and No. 4 at 150 per cent of the normal gas rate. These samples have approximately the same endpoint and gravity, and all the cracked samples contain a certain percentage of straightrun which has been estimated as shown. These stocks were blended as shown in Table 3, and antiknock ratings obtained. It will be noted that the antiknock ratings on the cracked samples themselves are approximately alike; viz., of the order of 33, and that this condition follows with diluted samples. It also shows that with plant straightrun gasoline, such as obtained at Bayonne, a mixture of 25 per cent of cracked distillate with 75 per cent of straightrun Venezuela will give antiknock ratings for the blended product which compare satisfactorily with commercial requirements.

TABLE NO. 3
DISTILLATION OF BLEND STOCKS PRODUCED AT VARYING GAS RATES FROM 21.3 GRAVITY VENEZUELA CRUDE

Sample No.—	1	2	3	4
Gas rate orifice meter differential . (Venezuela straight run)		40"	70"	90"
Per cent of normal	100	132	150	
A.P.I. gravity	53.5	54.4	54.2	52.9
Initial boiling point, ° F.	112	100	96	102
Endpoint, ° F.	418	393	397	399
Per cent over at 221° F.	19	22	21	20
Per cent over at 284° F.	49	51	51	50
Per cent over at 392° F.	93	94	93	93
50% point, ° F.	286	282	282	284
Per cent recovery ...	97	95	95	95
Straightrun % of charge		7	7	7
Straightrun % of distillate	100	25	25	25
Cracked % of distillate	0	75	75	75
Antiknock rating	15	32	33	33

BLENDS

Sample	Actual % straightrun content				Actual % cracked content	Ant'knock rating
5	62.50	50%	No. 1,	50% No. 2	37.50	30
6	62.50	50%	No. 1,	50% No. 3	37.50	31
7	62.50	50%	No. 1,	50% No. 4	37.50	30
8	81.25	75%	No. 1,	25% No. 2	18.75	28
9	81.25	75%	No. 1,	25% No. 3	18.75	28
10	81.25	75%	No. 1,	25% No. 4	18.75	28

GAS RATES

Gas rate % normal	Meter rates	Oil circulated (b. ls.)	M. cu. ft.	Equivalent (bbls.)	Per cent of oil circulated
100.00	40 in.	1,104	265	75	6.8
132.00	70 in.	1,104	350	99	9.0
150.00	90 in.	1,104	397	113	10.2

Limit for Operating

It will be evident from these results that antiknock values of distillates are not commensurately increased with gasification beyond the normal rate chosen, which may be considered a desirable limit for operating on this charging stock.

Antiknock values of distillates depend greatly on the character of the origin of the charging stock. Charging stocks derived from crudes which contain gasolines of favorable antiknock properties will yield distillates with better antiknock values than charging stock obtained from crudes containing gasolines with inferior detonating characteristics. It is also noticeable that antiknock values are not evenly distributed throughout the distillate. In the case of Venezuela crude, for instance, distillates with low endpoint of the order of 350° F. are substantially superior to those of 400 endpoint.

Table 4 shows a comparison between samples of distillate made at 15 pounds, 80 pounds and 100 pounds per square inch pressure, with approximately constant operating temperatures. It will be noted that the antiknock values of all these samples are approximately the same, actually showing some improvement in the 100-pound pressure sample. This, however, must be modified by the consideration of the lower endpoint which would normally give higher antiknock rating. It will also be noted that the color of the samples has been improved by pressure operation, at the same time the gum content has been reduced. It has been generally found over long periods of operation that pressure of the order of 80 to 100 pounds has reduced the gum content of distillates from 500-600 to 100-200. These results, together with others, indicate that operating under pressures of the order of 100 pounds is not appreciably detrimental to antiknock values as is sometimes believed.

TABLE NO. 4
EFFECT OF PRESSURE ON CHARACTER OF DISTILLATE

	15 lbs. per sq. in.		80 lbs. per sq. in.		100 lbs. per sq. in.
A.P.I. gravity ..	52.7	52.9	52.7	53.8	57.1
Initial boiling point, ° F.	107	104	120	100	98
Endpoint, ° F. ..	397	380	406	390	371
50% point, ° F...	274	276	300	284	248
Color (Saybolt) .	(*)	(*)	+7	0	+15
Gum (copper dish)	604	576	...	207	110
Gum (after dilution with equal vol. of straightrun gasoline)..	...	...	...	...	13
Antiknock rating	32	33	32	33	35

*Yellow.

Treating of Distillates

The treating of distillates formed at temperatures of about 1,050° F. and moderate pressures can be accomplished much more readily than with those formed at low pressures and equal operating temperatures. The pressure distillates can be treated with 6 pounds of acid to make a satisfactory finished product. In this connection it has been found that about 25 per cent of such distillates requires no treatment beyond alkali wash and sweetening. This portion of the distillates, which contains the lower boiling fractions, can be readily segregated and the acid treatment confined to the heavier portions, which suffer less from vaporization in refining. This method of handling distillates also results in better antiknock properties in the finished product.

Several methods are available for treating unsaturated distillates. Acid treatment has been used, however, as it is well known, simple and furnishes an excellent basis for comparison.

In the treatment of distillates it is somewhat difficult to arrive at what constitutes a satisfactory finished product, particularly from the point of view of gum content. The usefulness of the copper dish gum test is generally distrusted, and there is no doubt that the accepted standard imposes unnecessary conditions on distillates of this character.

Gum Content

The purpose of most antiknock distillates is to find their way into blends of straightrun gasoline, and the mere diluting of such distillates effects a very marked reduction on the gum content of the whole. Thus, distillates which may contain gums to the extent of 500 or 600 when diluted to 50 per cent with straightrun, show a gum content of the order of 30 to 60 on the copper dish tests. If, therefore, blends are to be made of the order of 50 per cent or less of cracked distillates, this phenomenon should be taken into consideration, and the requirement for gums on the cracked blend stocks need not be made so stringent as to require excessive treating, which usually tends to destroy antiknock values which have been laboriously manufactured. If the industry is interested in obtaining antiknock values from cracked distillates, progress will be accelerated by an intelligent consideration of allowable limits for certain properties inherent in distillates of this character.

One of the main objectives of the development, which has been briefly reviewed in the foregoing, has been to study the commercial possibilities of producing antiknock distillates by cracking. In view of the immense scope for research in this field it seems presumptuous at this time to voice definite conclusions with regard to the most favorable operating conditions required for commercial operations, which must necessarily involve economic considerations as well as technical ones, and must vary greatly with charging stocks available.

Results Obtained

Results obtained have justified the belief that cracking low grade charging stocks at temperatures of the order of 1,050° F. is practical and economical, even when process gas is valued as fuel. They have also clearly shown that it is feasible to build a cracking unit, at moderate cost, which will operate effectually on widely differing charging stocks and under widely varying operating conditions. This accomplishment is of major importance, as it furnishes a practical and conservative means of establishing an actual criterion of values between results of processing. In its present form the unit not only satisfies the variable requirements of refinery operation, but constitutes a safeguard to the commercial experiments essential to progress in extending the useful range of cracking.

Acknowledgment is made of the untiring efforts and interest of M. J. Ball and the operating men connected with the work which, together with the valuable chemical research of E. D. Streeter and important contributions of J. W. Gray, have been so largely instrumental in obtaining practical results.

WARNING OF INCREASING COST OF GOVERNMENT

(Continued from Page 127)

apart from the gasoline sales tax, the oil industry in the Middle West will be bearing as great a burden in indirect taxation as is borne by the direct tax upon its property. In the State of Missouri last year the Standard Oil Company of Indiana paid to municipalities $89,000 in indirect taxes, while bearing a burden of only $101,000 levied directly upon the property of its sales organization in that state.

Growth of Delinquency

The effect of these burdens is illustrated by the increase in the return of delinquent taxes in a great and prosperous neighboring state. In 1922, there were 400,050 city lots of an assessed valuation of $37,820,000 returned as delinquent; while in 1929, there were 973,109 lots of an assessed valuation of $1,086,806,000 returned as delinquent. In 1922, there were 6,788,732 acres of land of an assessed valuation of $118,253,000 returned as delinquent; while in 1929, there were 9,113,883 acres of land of an assessed valuation of $194,033,000 returned as delinquent. Delinquent taxes in 1922 amounted to $19,191,000; whereas in 1929 they amounted to $28,829,000.

The tax burden bears the relation to cost of government of effect to cause. The mounting cost of government is one of the problems of the hour, but it is hard to fully comprehend how rapid the increase has been in recent years. While I realize that statistics are hard things to make either plain or interesting, I find that I must make a short survey of governmental cost and its distribution to get my story over.

Increase 640 Per Cent

During the past 25 years, the total cost of federal, state and local governments has increased from $1,570,000,000 in 1903 to $11,623,000,000 in 1926, or 640 per cent. During the same period, the cost of the federal government increased from $521,000,000 to $3,644,000,000, or 600 per cent; the state governments from $155,000,000 to $1,727,000,000, or 1,014 per cent; local governments from $706,000,000 to $4,382,000,000, or 520 per cent. It is reasonable to presume that the cost of all government for 1928 was not far from $12,500,000,000, and for the current year that it will reach $13,000,000,000. If the later figure is approximately correct, then between 1903 and 1929 there has been an increase of 728 per cent in the cost of government; while the national income has increased but 340 per cent. In 1903, the cost of government was 6.7 per cent of the national income; while today it is more than 14.4 per cent, or about one-seventh. In other words, of every $7 of the income of Mr. Common-man, $1 goes to the tax collector.

President Hoover is credited with the statement that the expense of the United States Government will increase $140,000,000 during the next four years. This increase is attributed to the national defense, public works, farm relief, post office deficit, higher wages and decreased hours of employment. As a matter of fact, the total expenditures of 1928 over 1927 increased $204,000,000, according to the report of the Secretary of the Treasury, issued June 30 of this year. The total expenditures for 1927 were $3,644,000,000, and those of 1928, $3,848,000,000. The expenditures for 1927 over 1926, according to the "Statistical Abstract of the United States for 1928," increased $270,000,000; those of 1926 over 1925, $24,000,000, and those of 1925 over 1924, $11,000,000. The national income during the period from 1903 to 1928 increased from $20,500,000,000 to $90,000,000,000, or 339 per cent. In 1903 the federal Government cost 2½ per cent of the national income, while in 1926 it cost 4 per cent. The burden per person gainfully employed during the period from 1903 to 1926 increased from $16.50 to $74.29.

State Taxation Up

Turning to the states, we find the story repeated. In 1903, the burden of state government was $155,000.000, and in 1927 it had increased to $1,727,000,000, or more than 1,000 per cent. In 1903, the burden per person gainfully employed was $4.91 and in 1926 it was $29.28. In 1903 it was eight-tenth of 1 per cent of the national income, and in 1926, 1.6 per cent.

George Lord of Detroit, for years chairman of the Michigan Tax Commission, and one of the outstanding tax authorities of the United States, was reported by the press to have said that the public expenditures of the State of Michigan had increased in the past 10 years from $85,000,000 to $248,500,000, or 192 per cent; while the wealth of the State increased but 93 per cent.

Speaking of one of the counties of the State, he said that its total burden had increased during the decade from $1,903,000 to $14,455,000, or 659 per cent, while the wealth has increased but 257 per cent; that the county's share of the taxes of the State increased 275 per cent; that the school taxes increased 673 per cent; the highway taxes 790 per cent; that city taxes increased 1,055 per cent; and that village taxes increased 371 per cent.

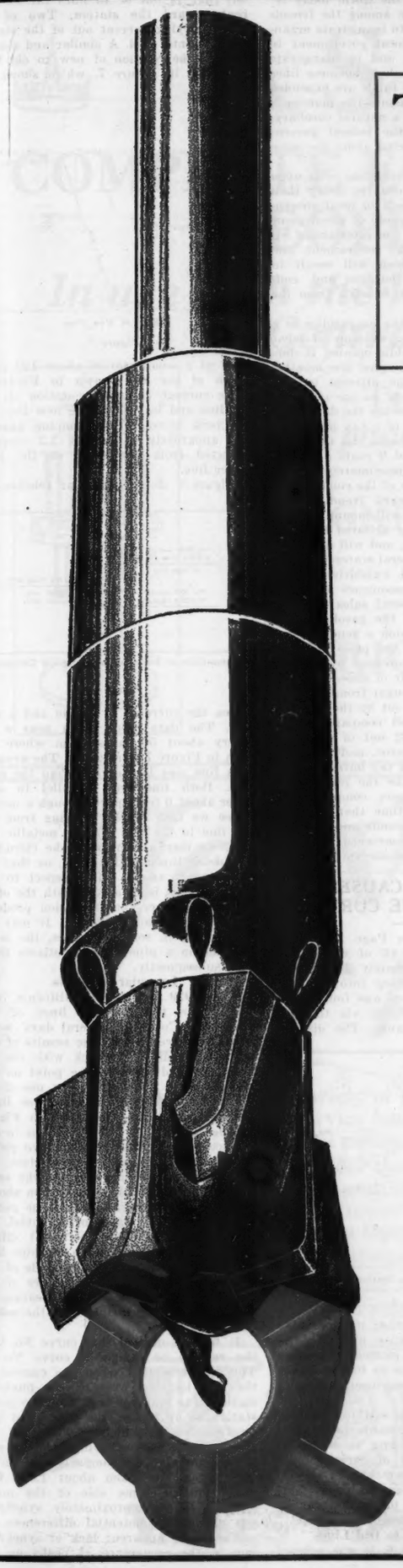
A certain township in this county had increased its burden of taxes during that period 326 per cent; its school taxes 410 per cent; its highway taxes 428 per cent; and its village tax 249 per cent; while taxable wealth had increased only 110 per cent. The story of Michigan is the story of every state in the Union.

In Cities and Townships

The burden of cities, counties and townships has kept pace with the states and the Nation. In 1903 this burden amounted to $706,000,000, which had increased in 1926 to $4,084,000,000, or 465 per cent. The burden per person gainfully employed increased during this period from $22.35 to $94.60. The percentage of national income increased from 3.4 per cent to 5.2 per cent.

The alarming fact cannot be escaped that, in spite of an unprecedented increase in national wealth, income and wages, the cost of government has increased more rapidly during the quarter of a century by 100 per cent.

The increase of public indebtedness is equally disquieting. At the present time, the total bonded indebtedness of all governmental units is, in round numbers, $30,000,000,000, on which there is an



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annual interest charge of $1,300,000,000. The federal debt is decreasing, but that of the states and their subdivisions is rapidly increasing. Of this debt, the federal Government was responsible in 1927 for $18,500,000,000, and the states and their subdivisions for $11,500,000,000. It will take more than $20,000,000,000 to liquidate this state and local debt. The interest charge on the federal debt was $787,000,000 in 1927, and on the state and local debt was $500,000,000 in 1928. Last year, $2,000,000,000 was raised by state and local government bond issues.

Government Cost Mounts

In attempting to analyze the financial history of this period, exclusive of the cost of the World War, we find an increase in the expenditures of the federal Government in spite of attempts at economy. While surpluses are pointed to with pride, an examination of the cost of the various departmental activities discloses the fact that, year by year, their cost is increasing. Add to this the ever increasing demand for paternalistic enterprises, and it is easy to discover why our federal tax bill is greater. Turning to the states and their political subdivisions, we find the same situation. Corruption and paternalism account for a large percentage of the increased local tax bill. But there is another factor which is unique in character, viz., the building of modern highways. In 15 years, the total expenditures for this purpose have increased from $240,000,000 to $1,600,000,000, or 567 per cent. In the year 1922 the total expenditures for the states and their subdivisions were $1,280,000,000, and in 1927, $1,727,000,000, or an increase of only 35 per cent. During the same period highway expenditures increased from $430,000,000 to $665,000,000, or 55 per cent. The revenues derived from taxation during the period increased $599,000,000. Of this total amount, the motor vehicle tax and gas tax were responsible for $396,000,000, or 66 per cent. In 1921 the special motor vehicle and gas taxes comprised 26 per cent of the total expenditures by states for highway purposes; and in 1927 they comprised 64.8 per cent. In brief, the phenomenal increased cost of state governments is, in a large measure, due to the building and maintenance of highways during the past 10 years. While the data is not obtainable, there can be no doubt that roads and streets have been a large factor in the increased cost of city and local government, and that the automobile and its fuel have borne much of this increased burden.

Gasoline Tax

While the automobile and the truck have borne the greater portion of this burden during the decade, the motor fuel tax has now become the favored handmaiden of the tax brigand, who visions a hard surface road on every section line in the United States. Last year, more than $300,000,000 was derived from this source, and during the current year the sum will probably be in excess of $400,000,000. At the present rate of increase it will not be long until this one commodity will bear a burden greater than the total cost of the federal Government before the World War.

Government through any period of time in recorded history has been controlled by the intelligence of the unit governed. While it is true that at times the mob has ruled temporarily, "if the will to power"—as our German friends would say—existed in the intelligent group or groups, they shortly regained control of government. The people of intelligence who believe in honest and efficient government, be they in the majority or the minority, can bring about such a government.

The great problem confronting the business interests of the world today is: to secure co-operation among the friends of good government; to inaugurate organizations to restrict local government to its proper functions, and to inaugurate plans of government along business lines to see that the public funds are expended in an economic and businesslike manner—and it will follow, as a natural corollary, that the state and the federal governments must be conducted along the same lines.

No more pressing obligation rests upon the business of this country today than that of interesting itself in local government—not for the purpose of privilege or gain directly, but in the interests of efficient and businesslike government, and the indirect gain which will result in more reasonable tax burdens and, conversely, greater public benefits from the burdens borne.

The history of the tax on gasoline is a startling and alarming example of what may happen when public opinion is dormant. Until within the past few months, there was virtually no attempt on the part of the oil industry to use publicity for the purpose of showing the dangerous and paralyzing effect of a tax burden of this sort upon a business. In the three states levying a tax of 6 cents a gallon, the tax represents approximately 33 per cent of the retail price of the commodity; and with the downward trend of the price, this percentage will mount. A general sales tax is being agitated throughout the entire country, and will doubtless come into being in several states with the convening of the next legislative assemblies. Is there any assurance that the history of such a general sales tax will not duplicate that of the gasoline sales tax? Is it hard to vision a general sales tax in 10 years, with the price of a 10-cent loaf of bread increased by such a tax to 13 cents; a pair of shoes from $6 to $8; or a pound of sugar from 5 to 6½ cents, as was pointed out by the publication of one of the oil companies in a recent issue? With $1 out of every $7 going to the tax collector, and with the prospect of a mounting tax burden in the future which will make the increase in the last 25 years seem comparatively mild, is it not high time that business interested itself in economic and efficient government? I am convinced that the alternative is the socialistic state.

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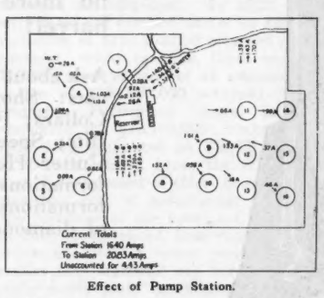
DEPARTMENTAL OIL AND GAS MINING LEASES FOR SALE

Sealed bids will be received at the Kiowa Indian Agency, Anadarko, Oklahoma, until 10:00 A. M., Thursday, December 5th, 1929, for oil and gas mining leases covering restricted allotted Indian land located in Caddo, Comanche, Cotton, and Tillman Counties, Oklahoma. For further particulars, general instructions and information, list giving descrip.ion of land, etc., write J. A. BUNTIN, Dist. Supt., in Charge, Kiowa Indian Agency, Anadarko, Oklahoma.

RESEARCH ON CAUSES OF PIPE LINE CURRENTS

(Continued from Page 130)

ward the station on all of these lines except three. Approximately 21 amperes was found to be flowing into the station. Seventeen amperes was found leaving the station principally via the bottoms of oil storage tanks. The discrepancy between the incoming and outgoing currents may be because not all lines carrying current were located or because of incorrect assumptions as to the weight of pipe upon which measurements were made.



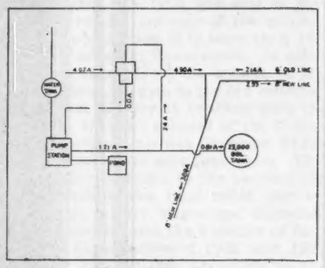
Effect of Pump Station.

Figure 6.

At three other pump stations, current was found to flow toward the station from both sides. The data in Figure 6 indicate that the flow of current is to the storage tanks rather than to the oil pumps. Other data seem to show that, occasionally at least, pump station operations affect the currents.

Relation of New to Old Lines

In discussing Figure 6, it was pointed out that 11 out of 13 lines carried current toward the station. Two of the lines carrying current out of the station were recently laid. A similar and simpler case of the relation of new to old lines is shown in Figure 7, which shows the

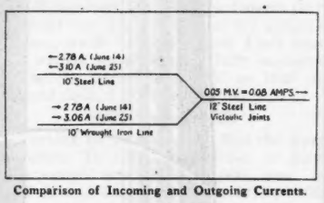


Effect of New Pipe.

Figure 7.

lines at a small station about 120 miles south of the one shown in Figure 6. Here current enters the station on the old line and leaves via the new line and the tank bottom. The pumping apparatus apparently sends out 1.2 amperes collected from the earth or the local water line.

Figure 8 shows a similar relation between the currents in an old and a new line. The data were taken near a refinery about 50 miles from where the data in Figure 7 were taken. The wrought iron line was laid earlier than the steel line. Both lines run parallel to each other about 6 feet apart through a marsh. Since we find current flowing from the old line to the new via the metallic circuit, we may assume that the circuit is completed through the earth, or that the new line is anodic with respect to the old one. This is in accord with the often expressed theory that corrosion products tend to accelerate corrosion. It may explain why, in some instances, the original line in a pipe system outlasts those laid subsequently.



Comparison of Incoming and Outgoing Currents.

Figure 8.

Irregular Currents

The 1929 work in California was started on two parallel lines of the Union Oil Co. After several days' work, it was discovered that the results of one day's tests did not check with the results obtained at the same point on the previous day. This led to the use of recording millivolt meters on these lines. Some of the data are shown in Figure 9. The curves show the variations in differences of potential between two points on the oil line under investigation. As the distances spanned are not the same for all of the curves, no attention should be paid to the magnitudes of the potentials. Only the changes of potential, the relations between the potential differences at different points on the pipe line, and the relation of the magnitude of the potentials to the time of day are of importance. The most striking feature of the curves is the variation of the potentials with time.

It will be noticed that curve No. 2 is the reverse or image of curve No. 1. This indicates that when the current at the test location west of the pumping station was flowing east into the pump station as at 4 p.m., the current at test location No. 2, which was east of the pump station, was flowing west or also toward the station. Comparison of curves Nos. 2 and 3, taken about 1,860 feet apart on the same side of the pump station, shows approximately synchronous changes in potential differences.

The slight apparent lack of synchronism in the occurrence of peaks on the

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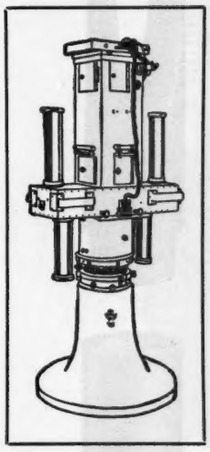

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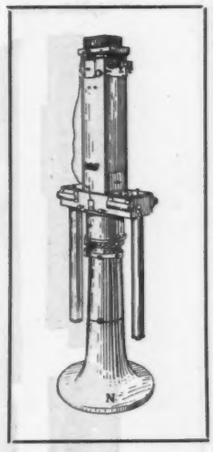

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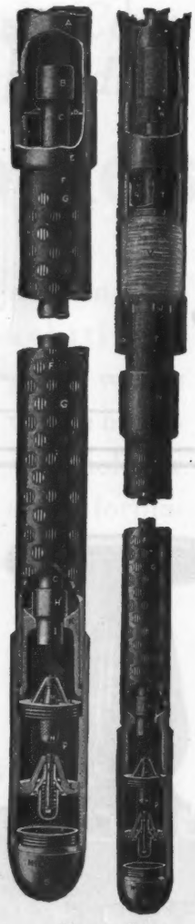

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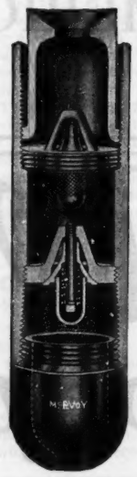

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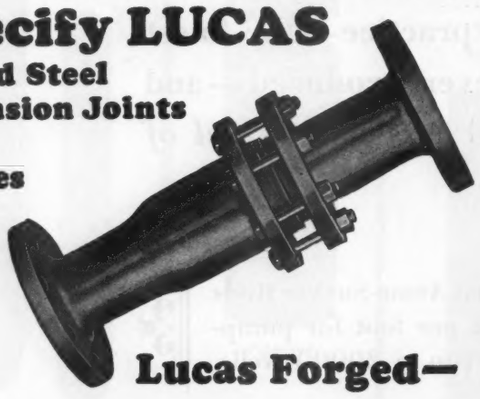

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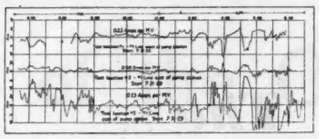
two lines is probably on account of errors in transcribing the data from the original circular charts, and because of



Fluctuating Currents.

Figure 9.

differences in instrument settings and operation.

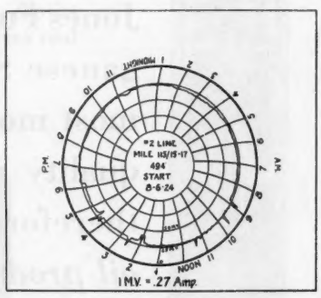
Fluctuations

Other observations—the data for which are not recorded here—indicate that the fluctuations on two adjacent parallel lines are synchronous, and that the variations in gradients at points on the same line, as much as 8 miles apart, may also be synchronous if no pump station intervenes.

These lines are 30 miles or more from the nearest electric railway line, and the shapes of the curves in Figure 9 are not characteristic of electric railway operation. The fact that the current flows in opposite directions on opposite sides of the pump station also indicates that the currents are not the results of electric railways. Several leaks have occurred along the line mostly in low places.

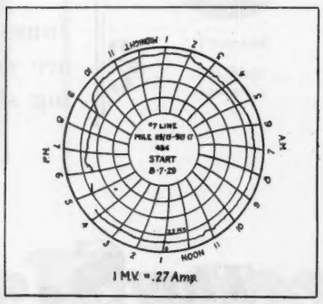
On account of the fluctuation of the current, determination of the relation between loss of current and corrosion was abandoned, and work begun on a line of the Standard Oil Co. in the San Joaquin Valley.

At the time of the preparation of this report, the study of the relation between line currents and corrosion has not been completed, and it will be necessary to limit the discussion of the data to the character of the voltage-time curves obtained. Figures 10 and 11 show potential differences observed at the same



Fluctuating Currents.

Figure 10.



Fluctuating Currents.

Figure 11.

location on successive days. The fluctuations in Figure 10 between 9 a.m. and 4 p.m. are such as might be expected if the oil line were crossed by an electric interurban car line, but no such condition exists, and the nearest city having a street railway is about 40 miles distant. Moreover, similar fluctuations of potential gradients were not observed on other oil lines in this territory on other days; nor were the fluctuations repeated on this line on the following day, as is shown by Figure 11. In the latter figure, it will be noted that there was a marked decrease in the current at about 9 p.m. and a gradual increase in current after 2 a.m. At 9 p.m., the operator of the pump station, about a mile from the place where the recording voltmeter was located, began to displace the oil in No. 1 line, which parallels No. 2 line, by pumping water into the line; and this operation continued until 2 a.m.

Accuracy of Data

The data which have been presented indicate many variations and irregularities. These may be accounted for by errors in observation or by changes in the cause of the currents. The first step in any analysis of the data must, therefore, be a determination of the accuracy of the observations. The potential differences were in some cases obtained by the use of a millivolt meter reading to 0.01 millivolt, and at other times with a portable potentiometer of about the same precision as that of the millivolt meter. These instruments should give results correct to within 5 per cent. The measurements of length were subject to about the same percentage error. There is a possibility of small thermal electromotive forces on account of differences of temperatures at the junctions of the voltmeter leads with the pipe, but experiments to determine the values of the thermal electromotive force indicated that under most of the test conditions this was negligible.

In many of the tests, readings were repeated on successive days or after longer intervals and found to differ but little, say 2 to 5 per cent.

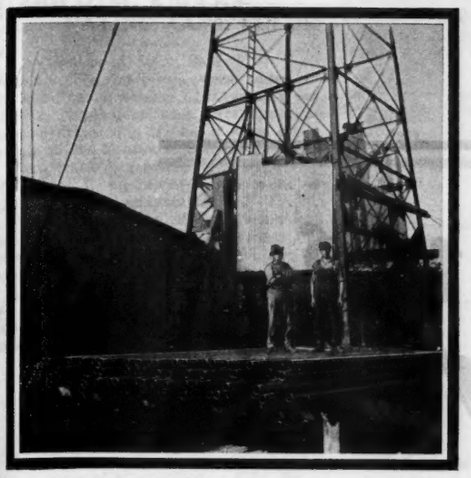
The computations of current involve the resistance of the pipe between the points of attachment of the potential leads. Measurements of the resistance of a large number of samples of pipe by the Bureau of Standards indicated that a variation of 5 per cent between samples of pipe nominally the same could be expected. The error in computing currents on pipe lines may, however, be greater than this, since in a number of cases the weights of the pipe sections were not known. Moreover, in order to expedite the measurements, no attempt to avoid spanning joints was made except in special cases. Our experience indicates that usually a screwed joint in an oil line adds no appreciable resistance to the line. We have, however, found two cases in which a measurable drop across a collar was observed. The nearness with which observations may be made to check when errors in assuming the resistance of the pipe are eliminated is illustrated in Figure 8, which shows 10-inch steel and 10-inch wrought iron line entering a Y-fitting which connects them to a 12-inch line having high resistance joints. All pipes were aboveground at the point of measurement. Current in the wrought iron line flowed toward the junction, in the steel line from the junction. Practically no current was found in the 12-inch line, so the currents in the two 10-inch lines should be identical. When the recorded weights of the pipes were used to determine the resistance of the pipes, the computed currents differed by about 20 per cent. When the resistances were determined experimentally, the results checked within about 1.2 per cent, as is shown in the diagram. The currents on two days differed by about 6 per cent.

Figures 3, 4, and 5 also show results obtained at selected points on different days. Other satisfactory checks on the reproducibility of the data were obtained. The only difficulty in reproducing results of tests were discussed in the paragraphs dealing with irregular currents. All things considered, we believe that most, if not all, the data presented are correct within 10 per cent, and probably the error is much less in most cases.

Causes of Pipe Line Currents

Before attempting to make use of our knowledge of pipe line currents, we should try to obtain an idea of their causes. Data for positively determining the origin of the currents discussed above are not available, but the data already

(Continued on Page 274)



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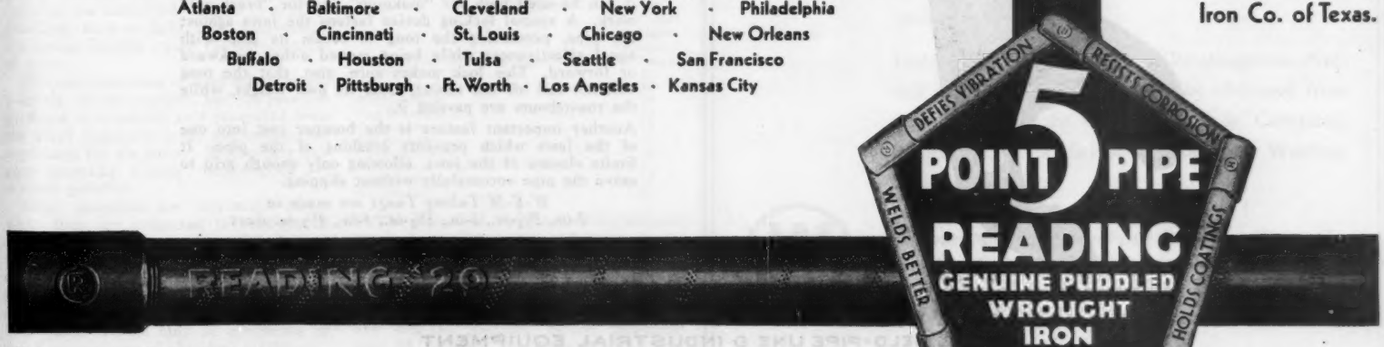

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The W-K-M Tubing Tong has a number of outstanding advantages. Without removing the tool from the tubing, it can be used both for "make-up" and for "break-out" work. A special locking device fastens the jaws against the pipe, permitting the tong to retain its grip with equal effectiveness while being moved either backward or forward. This lock makes sure, also, that the tong will not fall off the tubing, from its own weight, while the roustabouts are passing it.

Another important feature is the bumper cast into one of the jaws which prevents crushing of the pipe. It limits closure of the jaws, allowing only enough grip to move the pipe successfully without slipping.

W-K-M Tubing Tongs are made in 2-in., 2½-in., 3-in., 3½-in., 4-in., 4½-in. sizes

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STABILIZING KNOCKS RATING, GUM, COLOR

(Continued from Page 116)

oxygen. The inhibitors were added to the gasoline in weights of 0.1 grams per 100 cc. Napthalene, urea, pyrene, phthalic anhydride and carbazole were effective in a Mid-Continent cracked gasoline.

This cracked gasoline had a gravity of 58° A.P.I., an initial boiling point of 110° F., and an endpoint of 437° F.

Table 7 shows the effect of chemical inhibitors upon gum formation when the gasoline was exposed to sunlight for 24 hours.

The gum in the original gasoline was six milligrams per 100 cubic centimeters, and after exposure to sunlight, 15 milligrams.

TABLE 6

Cracked Gasoline	Mgs. Gum Copper Dish Method	Mgs. Gum Glass Dish Method
California before oxidation	11	Trace
California after oxidation	77	32
Pennsylvania before oxidation	19	3
Pennsylvania after oxidation	220	55
Mid-Continent before oxidation	9	2
Mid-Continent after oxidation	619	97
Mid-Continent before oxidation	68	1
Mid-Continent after oxidation	475	136

TABLE 7

Chemical Inhibitor	Mgs. Gum Glass Dish Method
Naphthalene	2
Pyrene	2
Phthalic anhydride	4
Urea*	6
60% Carbazole	6

*Urea in another gasoline increased the gum; the gasoline after exposure to sunlight showed 6 milligrams and the gasoline plus urea, 78 milligrams. This behavior emphasizes the fact that a chemical will not necessarily act as an inhibitor under all conditions.

Accelerated Oxidation Tests

Several cracked gasolines were subjected to the accelerated oxidation tests with and without the use of chemical inhibitors. It was found that aniline, dimethyl aniline, urea, hydroquinone and anthracene were effective in checking gum formation. The tabulated data present the experimental results obtained:

TABLE 8—PENNSYLVANIA CRACKED GASOLINE
(I.B.P. 94° F.—427° F. E.P.)

	Original Gasoline	After Oxidation	Inhibitors Aniline	Urea
Mgs. gum, Copper Dish	19	220	55	16
Mgs. gum, Glass Dish	3	55	5	6

MID-CONTINENT CRACKED GASOLINE
(I.B.P. 103° F.—320° F. E.P.)

		Hydroquinone	Anthracene
Mgs. gum, Copper Dish	68	475	26	73
Mgs. gum, Glass Dish	1	136	3.2	2.5

MID-CONTINENT CRACKED GASOLINE
(I.B.P. 110°—410° F. E.P.)

		Aniline	Dimethyl-aniline	Hydro-quinone
Mgs. gum, Copper Dish	25	331	9	22	11

Color Stability

Very little is known about the composition of the coloring matter in gasoline. It has been generally assumed to result from the chemical changes of the more highly unsaturated compounds. Factors favoring the formation of gum in cracked gasolines, such as light, heat, and oxidizing agents usually cause the development of color.

The decomposition of acid esters in improperly refined gasoline, and the reaction products of sulphuric acid generated from the alkyl sulphuric acids are responsible sometimes for the color. Elementary sulphur generally causes discoloration of cracked gasoline.

Some gasolines are not color stable when they are subjected to sunlight or ultra-violet light; or are stored for a long time. A high summer temperature may develop color in a short time. A deep yellow, green, brown, pink, or wine red color develops, depending upon the gasoline. This change may be prevented by small percentages of chemical inhibitors.

A gasoline produced from a Mid-Continent cracking stock, treated with 3 pounds of 66° Be. sulphuric acid per barrel, water washed, neutralized and distilled with fire and steam at a temperature of 350° F., was used in one series of color stability tests. The gasoline had a gravity of 58° A.P.I., an initial boiling point of 110° F., and an endpoint of 437° F.

One hundred cubic centimeter samples of this gasoline containing 0.1 gram of a number of chemicals, were exposed to 24 hours of sunlight. The changes in the color and the gum content were then determined. The data are shown below:

TABLE 9

Color before exposure	22
Color after exposure (no stabilizer present)	17
Mgs. gum / cc. by glass dish method before exposure	6
after exposure	15

Stabilizer used—	Color after 24 hrs. of sunlight	Mgs. Gum/ 100 cc. glass dish method
Gum camphor	22	20
Phenanthrene	21	18
Urea	21	6
Pseudo-cumene	21	9
Acenapthene	21	9
L-Methyl naphthalene	20	14
Anthracene	20	14
Naphthalene	20	3
Fluorene	20	11
Tetralin	19	13
B-Naphthol	19	14
Hydroquinone	19	12
Phthalic anhydride	19	4
Phthalimide	17	7
60% carbazole	15	6
Pyrene	10	2

Second Series of Tests

In a second series of tests a gasoline with a color of 20 Saybolt made by treating a Mid-Continent pressure distillate with 3 pounds of 66° Be. sulphuric acid per barrel, water washing, neutralizing, and rerunning at a still temperature of 375° F., was treated with 0.1 per cent by weight of the inhibitors. The gasoline without a stabilizer dropped to a color of 12 Saybolt on exposure for eight hours in sunlight. The results with the inhibitors are as follows:

TABLE 10

Inhibitor—	Color after sunlight exposure for 8 hours
Pseudo-cumene	16
L-Methyl-naphthalene	16
B-Methyl naphthalene	16
Fluorene (80-85% pure)	16
Pyrene	16
Acenaphthene	16

Third Series of Tests

A third series of tests was made with a cracked Mid-Continent gasoline, the color of which was 18 Saybolt. This gasoline when exposed to sunlight for three days without the addition of an inhibitor dropped in color to 14 Saybolt. The results obtained by using 0.1 per cent of weight of various inhibitors are as follows:

TABLE 11

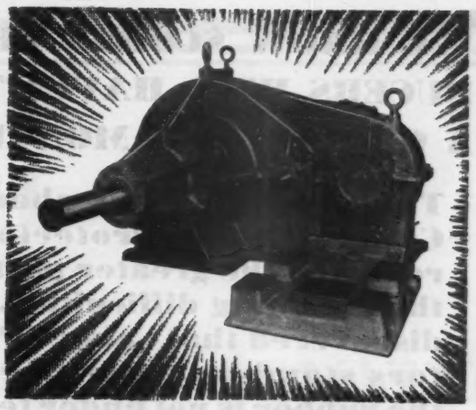
Inhibitor added to gasoline—	Color after sunlight exposure for 3 days
Tetralin	21
Urea	21
Phthalimide	19
Naphthalene	19
Camphor	19
Anthracene	18
Phenanthrene	18
Phthalic anhydride	18
B-Naphthol	16
Carbazole	14

The color of another Mid-Continent cracked gasoline, with and without the addition of traces of naphthalene and anthracene, was determined before and after exposure to sunlight in an atmosphere of oxygen. The original color of the cracked gasoline before treatment was 30 Saybolt. The color dropped during the exposure to 22 Saybolt when no inhibitor was present. However, when the inhibitors were used the color fell only to 28 Saybolt.

It must be acknowledged that a given chemical inhibitor may be effective as a color stabilizing agent with one gasoline and not with another under the same conditions.

Regenerating or Restoring Antiknock Properties

A series of experiments was made to



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develop methods for restoring or regenerating the antiknock properties of depreciated gasoline.

The first tests were made with refining agents and a Pennsylvania cracked gasoline having an original benzol equivalent of 40 which had been depreciated in knock rating by the accelerated oxidation treatment to a value of 29 per cent.

Another set of tests was made with a Mid-Continent cracked gasoline which had been depreciated by the same method from a benzol value of 56 to a value of 37.

Good results were obtained in restoring the antiknock properties of the Mid-Continent cracked gasoline by treatment with any of the following treating agents: Fuller's earth, 75 per cent sulphuric acid, 95 per cent sulphuric acid, 16° Be. caustic soda, 40° Be. caustic soda; and borax in the rerun stills. With the same treating agents applied to a Pennsylvania cracked gasoline, all but the fuller's earth and the 40° Be. caustic soda gave partial or full regeneration.

The detailed results on regeneration are shown in the following table:

TABLE 12
RESTORATION OF KNOCK RATING PENNSYLVANIA CRACKED GASOLINE

	Original gasoline	After oxidation	3 lbs. per bbl. fuller's earth	Rerun over borax	3 lbs. 95% H_2SO_4	3 lbs. 75% H_2SO_4	3% 16°Be. NaOH	3% 40°Be. NaOH
I.B.P. °F.	94	114	106	115	119	120	114	112
E.P. °F.	427	434	434	439	436	438	434	437
Color Saybolt	24	—16	—11	+16	30	28	—16	—11
Mgs. gum copper dish	18.7	220	257	30.9	5.1	10.5	178	144
Mgs. gum glass dish	2.3	55	35	2.8	2.5	2.8	38	22
			Hydrocarbons					
Per cent—								
Unsaturates	24.0	23.0	...	...	...	...	...	...
Aromatics	22.9	22.5	...	...	...	...	...	...
Naphthenes	9.3	10.1	...	...	...	...	...	...
Paraffins	43.8	44.4	...	...	...	...	...	...
			Delco Motor Test					
Benzol equiv. %	40	29	27	40	40	37	35	29
			MID-CONTINENT GASOLINE					
I.B.P. °F.	103	114	118	114	119	120	112	114
E.P. °F.	320	335	314	310	315	307	304	302
Color Saybolt	+130	+7	+10	+16	+18	+16	+16	+15
Mgs. gum copper dish	68	475	580	83	55	73	347	219
Mgs. gum glass dish	1	136	150	2	1.0	1.5	78	47
			Hydrocarbons					
Per cent—								
Unsaturates	36.2	41.1	...	...	...	...	...	...
Aromatics	12.0	7.8	...	...	...	...	...	...
Naphthenes	11.9	11.7	...	...	...	...	...	...
Paraffins	39.9	39.4	...	...	...	...	...	...
			Decio Motor Test					
Benzol equiv. %	56	37	48	50	51	51	50	52

Experiments for Restoration

Another set of experiments for restoration was made with a Mid-Continent cracked gasoline using reagents having reducing properties. The gasoline was exposed to sunlight in an atmosphere of oxygen to depreciate its knock rating. Sodium hydrogen sulphite, stannous chloride, and acetic acid and zinc restored the depreciated gasoline from a knock rating of 16 per cent practically to its original benzol equivalent of 32 per cent.

The treatments were as follows:

1. Washing the depreciated gasoline with 10 per cent by volume of a saturated solution of sodium hydrogen sulphite and then washing with water.
2. Washing with 10 per cent by volume of a saturated solution of stannous chloride.
3. Refluxing for two hours with 10 per cent by volume of glacial acetic acid and zinc dust, washing with water, neutralizing with caustic soda and then water washing.

The results are shown in the following tabulation:

TABLE 13

	Original gasoline	Gasoline after oxidation	Sodium hydrogen sulphite	Stannous chloride	Acetic acid and zinc
Color—	20	Yellow	Light orange	Yellow	Yellow
Gum-Mg./100 cc. copper dish method	25	330	330	...	326
% Benzol equivalent	32	16	30	28	30

Other reducing agents would probably show similar results in regeneration of the gasoline. These data lend added support to the theory that the chemical inhibitors act as antioxidants.

Conclusions

1. Although most cracked gasolines are satisfactorily stable during storage with respect to color, gum and knock rating, there are some that deteriorate.
2. There is no regularity in the formation of gum and lowering of knock rating.
3. The accelerated oxidation test for gums is applicable as an accelerated test for depreciation of knock rating of a gasoline.
4. Chemical inhibitors have been found which prevent loss of knock rating during accelerated oxidation.
5. New chemical inhibitors have been found which prevent gum formation during the accelerated oxidation of gasoline. It is expected that they will be effective in stored gasoline.
6. New chemical stabilizers of color for stored gasolines have been found.
7. Processes for the restoration of cracked gasoline which had depreciated in knock rating have been developed.

SATISFACTORY FACTORS IN DETERMINATION OF GUM

(Continued from Page 124)

nical crotonaldehyde is dissolved in a saturated straightrun gasoline and exposed to the action of oxygen in the light, pseudo-gum forms very rapidly; and the residual gum formed from it possesses odor, color, and solubility characteristics quite similar to the residual gum produced from old cracked gasolines. (See Table 4.) These facts give strong indication that the two gums are of similar origin.

TABLE 4

	Grams residual gum per 20 cc. sample	
	Fresh	Old
5% crotonaldehyde solution	0.0045	0.0428
10% crotonaldehyde solution	0.0209	0.0836

It is interesting to observe the action of alcoholic potash on gasoline containing pseudo-gum. When a small amount of alcoholic potash solution is dropped into a diluted sample of such gasoline, a reddish-brown resin is formed, quite analogous to the action of alcoholic potash on diluted aldehydes. Preliminary work in this laboratory indicates that when this resin is dissolved in alcohol, the resulting depth of color of the solution is proportional to the residual gum value of the gasoline. When alcoholic potash is added to gasoline high in pseudo-gum, the reaction is almost explosive in violence. While this does not prove that aldehydes are the pseudo-gum, it does mean that the production of aldehydes runs hand in hand with the formation of pseudo-gums.

Enlightening on the mechanism of pseudo-gum formation is the action of oxygen on highly gasoline free from pseudo-gum. Such gasoline, kept in the dark in a tightly stoppered glass bottle

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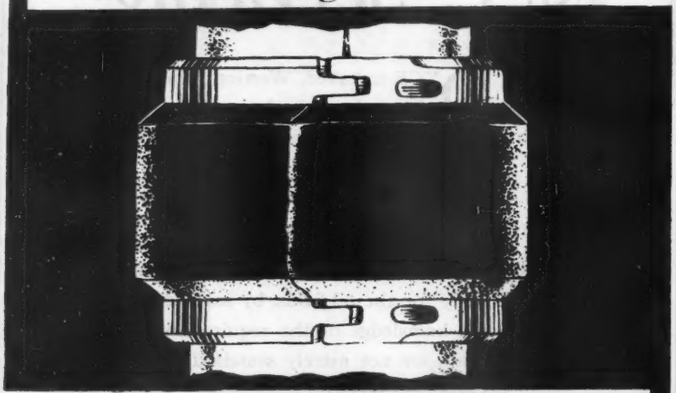

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and under an atmosphere of pure oxygen, appears to remain free from any great amount of pseudo-gum for quite a long period of time. Table 5 shows a representative run.

Period of Induction

This stationary state in the oxidation of pseudo-gum-free unsaturated gasoline is the so-called "period of induction." Its existence is often explained on the assumption that an anticatalyst is present in the gasoline which retards the oxidation until the anticatalyst is completely used up. As a matter of fact, it is known that such materials as water have an inhibiting effect on certain auto-oxidations. In view of the very widespread character of this "phenomenon," however, even with highly purified materials, we do not believe that the explanation of the "induction period" necessarily involves the assumption of an anticatalyst. A much simpler explanation, at least in the case of cracked gasolines, appears to us to lie in the two following assumptions:

1. At ordinary temperatures and in the absence of catalysts or light, pure oxygen does not attack pure hydrocarbons.

2. Among the products of atmospheric oxidation of hydrocarbons are materials which catalyze further the atmospheric oxidation, i.e., the atmospheric oxidation of hydrocarbons is an auto-catalytic reaction.

Thus, the "period of induction" may be interpreted as being the beginning of the auto-catalytic reaction, the measurement of the minute quantities of the reaction products falling within the limits of experimental error.

The first of these assumptions appears probable from results similar to those in Table 5. The truth of the second assumption appears to have been tacitly accepted for some time. Although the existence of auto-catalysis is not so highly pronounced at room temperature (occasioned perhaps by the formation of some intermediate, fairly stable compound), the phenomenon is very evident at 100° C. as has previously been described by Voorhees and Eisinger. We have run a parallel experiment, placing 100 cc. of fresh vapor phase gasoline in an old calorimetric bomb and filling the bomb with oxygen at 310 pounds pressure. A pressure gauge was fitted to the bomb, and the bomb immersed in boiling water. Table 6 shows the rate of oxygen absorption.

The gasoline thus oxidized smelled strongly of acrolein, and the gallic acid test (Mulliken) showed acrolein to be present.

It was found that old cracked gasoline imparts an acid reaction to water with which it is shaken. It, therefore, seemed possible, in view of the inactivity of the olefin bond, per se, that the catalyst might be an acid. This view was strengthened by the discovery that a trace of hydrogen chloride gas not only caused slight polymerization in fresh vapor phase gasoline, but also promoted profound oxidation. A trace of chlorine gas acted similarly. Glacial acetic acid, on the other hand, showed only a faint catalyzing action. Alpha-crotonic acid acted similarly to glacial acetic acid. A mixture of nickel and cobalt acetates, however, although practically insoluble in the gasoline, showed a considerable activating influence. Anhydrous calcium chloride was especially active, whereas the hydrated calcium chloride showed a greatly diminished activity. Table 7 shows sample tests.

Relative Catalytic Actions

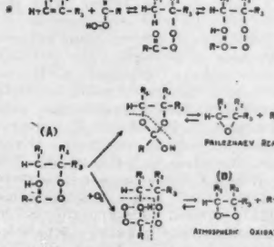
We are leaving the complete theory of oxidation catalysts, along with new experimental data, for a paper to be presented in the near future on the question of determining the pseudo-gum stability of gasolines. It will be sufficient for the purpose at hand to point out the relative catalytic actions of weak and strong acids. From the data, it would appear evident that if the catalyzing substances are acids, they must then be stronger than the common organic acids. This suggests the thought of per-acids, if one assumes for the present that such acids in hydrocarbon solution are indeed stronger than their respective parent acids. There can be little doubt that such per-acids are present in gasoline containing pseudo-gum. This is indicated by the fact that aldehydes, when exposed to an atmosphere of oxygen in the presence of sunlight, appear to form per-acids, along with pseudo-gum. The presence of peroxides in aldehydes, which in nonaqueous solution are exposed to the action of oxygen and light, may easily be shown with potassium iodide solution. Old cracked gasoline gives the same peroxide test. Here, too, may be mentioned the fact that when the undiluted aliphatic aldehydes, such as acetaldehydes or crotonaldehyde, are exposed for several hours to the action of oxygen and light, and then dissolved in water and evaporated on the water bath, residual gums are formed possessing characteristics of sugar derivatives. Similar residual gums are formed on evaporation of the wash water from gasoline containing pseudo-gum, as was mentioned previously. Such wash waters always appear to give the peroxide reaction.

Auto-catalysis

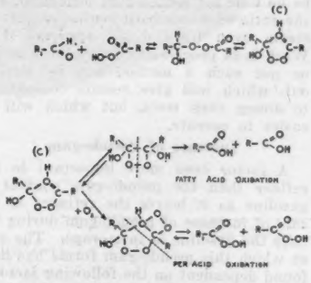
If, then, the oxidation of gasoline is an auto-catalytic one, and if the catalytic agents are per-acids, they would have to react differently from the Prilezhaev reagents; for auto-catalysis requires an increase in the amount of catalyst with time, whereas the Prilezhaev reaction would lead to a decrease in the amount of catalyst. Furthermore, the Prilezhaev reaction does not take account of atmospheric oxidation in its theoretical equation. Rather, the action of atmospheric oxidation on the olefinic bond seems to be the addition of two oxygen atoms instead of one, resulting in compound of the type

Such compounds appear then to oxidize themselves further, splitting the double bond completely with the formation of aldehydes and ketones, the former, at least, then absorbing an oxygen molecule for the further formation of the catalytic per-acid.

Taking the various factors heretofore cited into account, a simple scheme of reaction for the mechanism of pseudo-gum formation can be devised, which furthermore shows a relationship which may exist between such a reaction and the Prilezhaev reaction:



Thus, through the medium of reactive oxonium compounds of Type A, the per-acid would be regenerated, along with the hydrocarbon peroxide, B, which latter can break into an aldehyde and a ketone, the aldehyde being then further oxidized in the presence of the per-acid, somewhat as follows:



We are inclined to believe the pseudo-

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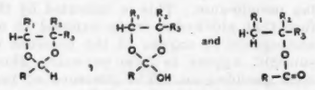
gum to be compounds of Type A and its degradation products, i.e., esters and acetals:



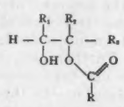
That compounds of Type C can play but a minor role in residual gum formation may be shown by exposing to sunlight acetaldehyde dissolved in the inert hydrocarbon medium. After an hour's exposure, the solution shows an intense peroxide reaction, but gives comparatively little residual gum. Table 8 illustrates this point, showing how the residual gum formation is very considerably increased when an unsaturated aldehyde (crotonaldehyde) is substituted for the saturated acetaldehyde.

TABLE 8

	Grams residual gum Before exposure	Grams residual gum After exposure
10% acetaldehyde solution..	0.0069	0.0109
10% crotonaldehyde solution	0.0055	0.0253

Glycol Esters

Type A compound, when heated in non-aqueous solutions, would tend to form glycol esters of the type:



which could then polymerize with the expulsion of water to form ester, olefins and furan derivative gums. Condensation might also occur with the less volatile aldehydes and ketones. In aqueous solutions, hydrolysis would occur to form di- and polyhydric alcohols, i.e., sugar derivatives. While we do not claim that the structure of residual gum is exactly as here presented, we do believe that residual gum formation takes place along the general lines herein indicated, with compounds of Type A and its degradation products in the role of pseudo-gum.

If this theory is correct, and compounds of the type of A and its degradation products are the main constituents of pseudo-gum, then the behavior of gasoline samples evaporating on the steam bath is at once explicable. Some molecules of A combine, each with a molecule of oxygen, and then split up to regenerate the per-acid which started A on its career together with a molecule of B. B splits up into aldehyde and ketone, and the aldehyde molecule with one molecule of per-acid and one of oxygen manufactures two molecules of per-acid. The stability of the intermediate compounds A, B and C is naturally the factor which controls the rate of formation of pseudo-gum, subject, of course, to the effects of temperature, mass action and catalysts. Given therefore, the same quantity of per-acid (or A, B and C), the same temperature (that of the water bath), and the same time (that required to evaporate the 20 cc. of gasoline), the quantity of pseudo-gum formed during the evaporating period should be some multiple of the pseudo-gum originally present. The larger the sample taken for test, the greater will this be, because of the longer evaporating time and the more uncontrollable variables that will be introduced. Conversely, if the sample taken could be made infinitely small, then there would be no time for pseudo-gum formation, and the ratio of water bath method results to steam oven tests would approach 1:1. Work is in progress to determine whether or not such a method can be worked out, which will give results comparable to steam oven tests, but which will be easier to operate.

Increase of Pseudo-gum

A factor even more important to the refiner than the pseudo-gum content of gasoline as it leaves the refinery is the rate of increase of pseudo-gum during the time the gasoline is in storage. The rate at which this pseudo-gum forms has been found dependent on the following factors: time of exposure to the atmosphere, concentration of oxygen in the atmosphere over the gasoline, the kinds and percentages of the various unsaturated compounds in the gasoline, the temperature of the system, the rate of diffusion of the oxygen through the gasoline, and the extent to which actinic rays or other catalyzing influences may have had access to the gasoline.

TABLE 5

	Grams residual gum per 20 cc. sample gasoline
Start	0.0004
16	0.0004
36	0.0006
45	0.0010
110	0.0020

TABLE 6

Time (min.)	Pressure (lb.)	Decrease
Start	310	..
10	270	40
20	220	50
30	160	60

TABLE 7

Catalyst—	Days	Grams residual gum per 20 cc. sample gasoline
Trace hydrogen chloride	Start	0.0001
	5	0.1256
	9	0.2233
Trace chlorine	Start	0.0001
	10	0.1703
5% glacial acetic acid	Start	0.0004
	18	0.0021
	45	0.0036
Mixed nickel and cobalt acetate crystals	Start	0.0004
	1	0.0004
	38	0.1040
Anhydrous calcium chloride (lumps)....	Start	0.0012
	8	0.0350
	21	0.3123
Hydrated calc. chloride ($CaCl_2 \cdot 6H_2O$ crystals)	Start	0.0004
	51	0.0827

A reliable method for the determination of pseudo-gum stability is very much to be desired. If any such method is to have any practical application, however, and if the method is based on oxidation, then it should go without saying that such oxidation must be mild enough to be an index for actual oxidizing conditions such as are met with in the storage tanks. This point appears to have been overlooked by Voorhees and Eisinger, when they advocated their method for the determination of "potential gum." In this method, a 25 cc. sample of the gasoline to be tested is put in flask under oxygen, and placed in an actively boiling water bath for five hours, after which the contents of the flask are evaporated in the steam oven. Table 9 shows average results obtained by the use of the abovementioned method, along with the order of gum stability as determined by actual field tests:

TABLE 9

Gasoline No.	"Potential gum" grams	Order of pseudo-gum stability
1	0.0098	1
2	0.1993	2
3	0.1519	3
4	0.0345	4
5	0.2608	5
6	0.2207	6

The authors have been working for a considerable time on the problem of finding a reliable method for checking the pseudo-gum stability of gasolines. The path appears to lie in the direction of mild catalysts, and work along this line is now in progress.

APPLICATIONS OF THERMODYNAMICS

(Continued from Page 118)

portunities for research of fundamental and technical importance.

Furnishing a Check

It was of great interest to find some cases where free energies of two or more compounds as found from entropy could be related by an actual equilibrium, and thus furnish a check upon the calculations and upon the assumptions involved in the third law itself. The agreement is within experimental error in the case of simple compounds such as carbon monoxide and dioxide, methane and water. Another case is that of benzene and cyclohexane, where the final check is within 50 calories, although heats of combustion of nearly 1,000,000 calories are involved. In still another case, however, the synthesis of methanol, the discrepancy is of

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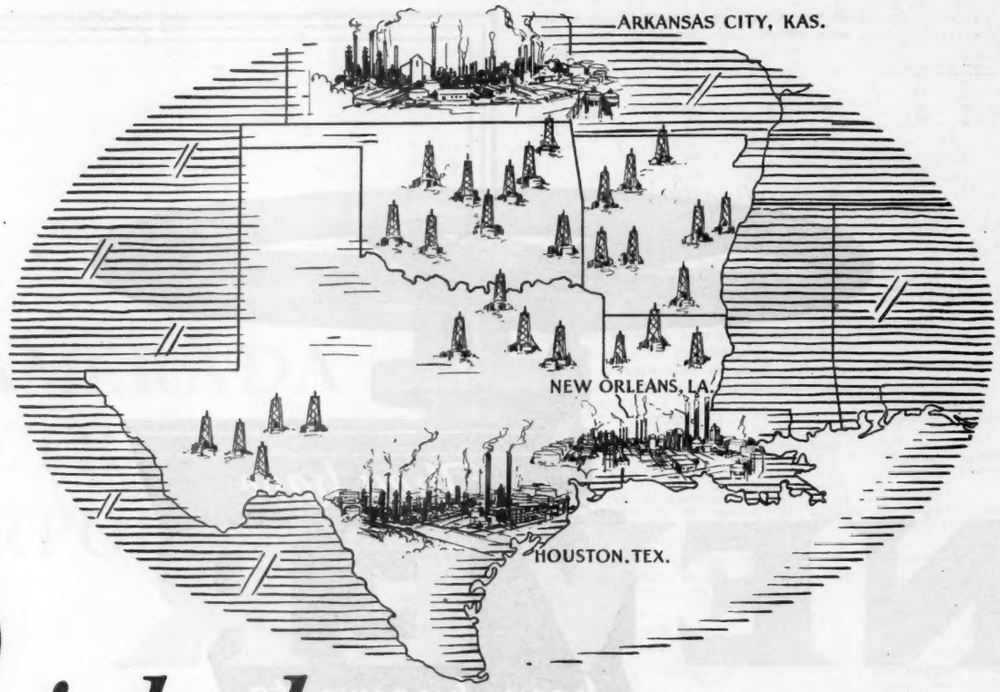

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the order of 5,000 calories, or several times the apparent experimental error. This discrepancy is recognized by others, and investigation is going on to learn its cause. In the case of another alcohol, tertiary-butanol, an actual equilibrium studied experimentally by Francis combined with a rough approximation for the hydrocarbon isobutane, shows a discrepancy of the same order and sign as that of methanol. These discrepancies are probably caused by various assumptions made in simplifying the free energy calculations, and indicate the need for more accurate data on the physical properties of the substances involved.

The calculations in previous papers, "Free Energies of Some Hydrocarbons," and "Free Energies of Some Alcohols," were recalculated in the same manner given there, but with the following new and revised data:

Molar Heat Capacity, Cp. (Calories)

		Ref.
C	$-1.4+0.014T-0.0_5T^2$	9
H_2	$6.6+0.0007T$	9
O_2	$6.98+0.0002T$	9
N_2&CO	$6.32+0.0003T$	9
CO	$7.18+0.0104T-0.0_567T^2$	9
$H_2O(1)$	$19.55-0.0098T+0.0_5156T^2$	9
$H_2O(g)$	$9.5-0.0029T+0.0_525T^2$	9
CH_4	$2.52+0.0233T-0.0_543T^2$	9
$C_6H_{12}(1)$	$78.5-0.24T+0.0006T^2$	10
$C_6H_{12}(g)$	$23.2+0.06T$	11
C_2H_4	$5.2+0.016T$	9
$C_6H_6(1)$	$8+0.08T$	9
$C_7H_8(1)$	$36.14-0.0612T+0.000214T^2$	12
$C_{10}H_8(s)$	$-2.79+0.1418T$	9
$C_{10}H_8(1)$	$10.64+0.1078T$	9
$CH_3OH(1)$	$21.41-0.0565T+0.000166T^2$	13

	Molar heat of formation at 25°C. ΔH	Free energy of formation at 25°C. ΔF	Reference
C_2H_2	−23,400	−11,080	14
$C_5H_{12}(1)$	−65,500	− 9,600	10
C_2H_4	+ 9,558	.....	14
C_3H_2	+54,340	.....	14
$C_6H_6(1)$	+11,120	+27,300	12
$C_7H_8(1)$	+ 1,930	+26,250	12
$C_{10}H_8(s)$	+13,700	+40,800	10
$C_6H_{12}(1)$	−37,600	+ 3,300	10

Molar Heat of Vaporization

C_7H_8	7,956	14
C_6H_{12}	7,200	14
$C_{10}H_8$	9,670	14

$CH_4+2H_2O \rightleftarrows CO_2+4H_2$	$K_{775}=0.037$	15
$C_2H_6 \rightleftarrows C_2H_4+H_2$	$K_{875}=0.0310$; $K_{925}=0.082$; $K_{975}=0.20$	16
$CO+2H_2 \rightleftarrows CH_3OH$	$K_{676.9}=0.000557$	8
$C_4H_8+H_2O \rightleftarrows C_4H_9OH$	$K_{333}=1.25$; $K_{440}=0.021$	17

The results are as follows:

TABLE 1—Free Energies of Formation (Gas) from the Elements

H_2O—57,534+0.65T1nT+0.00185T^2—0.0$_6$4T^3+5.89T
CO—27,288—4.73T1nT+0.0069T^2—0.0$_5$13T^3+7.4T
CO_2—94,586—1.60T1nT+0.0019T^2—0.0$_5$22T^3+11.14T
CH_4—16,060+9.4T1nT—0.00395T^2+0.0$_6$6T^3—40.44T
C_2H_6—20,475+10.92T1nT—0.003T^2—29.8T
C_2H_4—46,030+25.6T1nT+0.017T^2—20.9T
C_2H_2+11,216+4.62T1nT+0.0037T^2—22.38T
C_3H_8 54,000—224T1nT+0.00385T^2—4.5T
C_4H_8 21,388+5T1nT+0.009T^2—7.32T
C_3H_6 15,480+6T1nT+0.025T^2—5.5T
$C_{10}H_8$ 31,500+8.72T1nT
C_6H_{12}—23,000+24.75T1nT—0.0025T^2—47.3T
H_2O (liquid)—70,788—9.4T1nT+0.0053T^2—0.0$_5$26T^3+99.93T
CH_3OH—57,434+48T
Tertiary Butanol—85,000+127T
C_nH_{2n+2}(paraffins)—10,200—8,633$_n$—2.56T+26.09$_n$T
C_nH_{2n}(olefins) 22,090—8,633$_n$—32.56T+26.09$_n$T (700—1,000° K)
22,550—6,815$_n$—33.2T
+23.5$_n$T (500—700° K)
C_nH_{2n} (naphthenes) 10,375—8,633$_n$—15.90T+26.09$_n$T
C_nH_{2n}—2 (acetylenes) 70,425—8,633$_n$—67.50T+26.09$_n$T
$C_nH_{2n+1}OH$ (normal alcohols) —29,000—6,000$_n$+18T—23$_n$T
$(C_2H_5)_2O$—70,000+126T
CH_3COOH—104,300+36.8T
CH_3CHO—42,600+19.75T
$CH_3COOC_2H_5$—102,000+55T

The free energy of methanol vapor was computed from the most recent value for liquid methanol, —44,200 calorie at 25° C., giving the equation:

$$\Delta F=-48{,}130+14.81T1nT-0.0105T^2-64.8T$$

or approximately

$$\Delta F=-53{,}170+32.07T$$

However, from Smith's equilibrium data at 303.8° C., the value $\Delta F_{576.9}=-29{,}734$ results instead of —34,688 given by the above equation. Furthermore, the value $\Delta F_{673}=-25{,}130$ was obtained from Fieldner's and Brown's calculation of the data of Audibert and Raineau. Accordingly, we adopt the empirical equation:

$$\Delta F=-57{,}434+48T$$

which fits these two values and also that at room temperature, —43,130 obtained by vapor pressure from the above value for liquid methanol, although this last equation is inconsistent with the specific heat equation.

Synthesis of Alcohols

Since nearly the same correction was necessary for the free energy of tertiary butanol vapor, it was considered best to apply it also to the equations for the vapors of the other alcohols as obtained from specific heat equations. This makes the catalytic synthesis of alcohols by direct addition of water to olefins:

$$C_nH_{2n}+H_2O \rightarrow C_nH_{2n+1}OH$$

seem less favorable than previously. Combining the equations for alcohols, olefins, and liquid water, the free energy of this synthesis is:

$$\Delta F=-5{,}320+815_n+17.2T-0.5_nT^2$$

For ethyl alcohol, this becomes —3,690+16.2T, so that apparently the tendency is toward decomposition at all ordinary temperatures. The application of sufficient pressure to the olefin should overcome the decomposition tendency, and numerous attempts have been made to accomplish this synthesis, but no catalyst has been found yet capable of inducing the reaction at a reasonable rate, except in the case of tertiary alcohols. Of course, the reactions can be brought about indirectly by absorbing olefins in sulphuric acid, and hydrolyzing by dilution and distillation; but this is not catalytic, nor is it usually economic. A comprehensive experimental study of these equilibria might be extremely valuable.

The equations given for the last four compounds—ether, acetic acid, acetaldehyde and ethyl acetate—are rough estimates using heat capacities of vapors.

Complete Equations

The complete equations for all the individual hydrocarbons have been plotted in Figure 1. The ordinates have been reduced to free energy of formation per carbon atom, since free energies are extensive functions, and a comparison of two hydrocarbons with different numbers of carbons would otherwise be misleading.

Strictly speaking, we should compare the changes in free energy when starting with a definite weight of each of the elements involved. Since, however, the carbon-hydrogen ratio is not very different for various hydrocarbons, a certain simplification is possible, within the limits of accuracy of our present knowledge of basis data, by use of the "per carbon atom" basis selected. In general, compounds like methane, with a low percentage of carbon, have lines in Figure 1 which are somewhat too steep. In the case of compounds containing oxygen,

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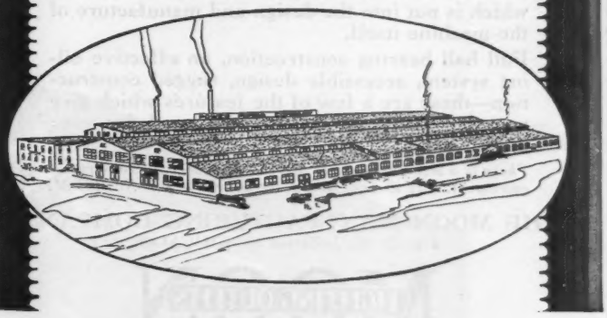

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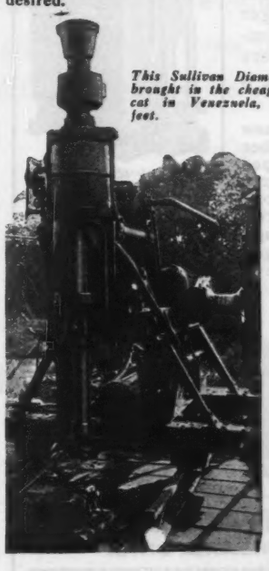

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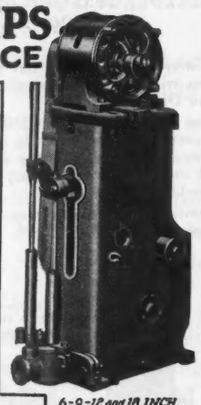

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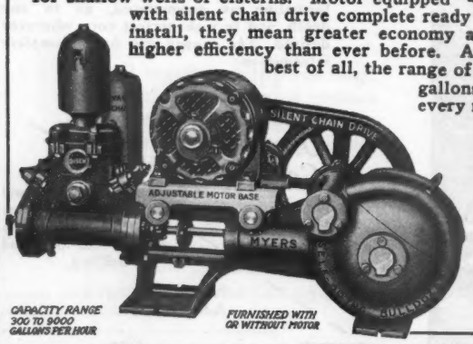

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this method fails completely, since the weight of oxygen involved is a large and very variable percentage of the total weight. Such compounds are, therefore, plotted on a different basis, described later in connection with Figure 2.

Figure 1 shows the free energies of gaseous hydrocarbons with respect to their elements and, therefore, is useful in predicting thermal reactions (cracking). The thermodynamic tendency at any temperature is from a higher to a lower line in the figure. The relations between liquid hydrocarbons would be similar, and could be calculated for any individual case by the correction factor:

$$\Delta F = RT \ln \frac{p_2}{p_1}$$

where p_1 and p_2 are the vapor pressures of the two compounds considered.

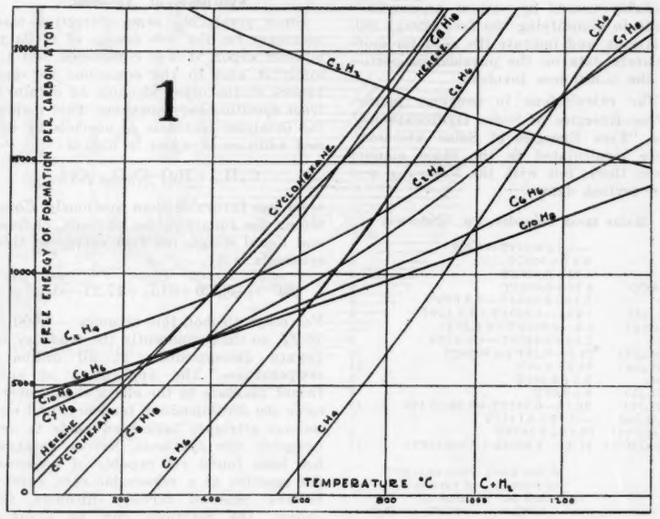

Figure 1—Applications of thermodynamics to chemical reactions of petroleum products.

Paraffin Hydrocarbons

The paraffin hydrocarbons have nearly parallel lines. The olefins have lines with much less slope, but the higher olefins approach the higher paraffins, as should be expected. Cyclohexane is intermediate between the higher olefins and the higher paraffins. The lines for aromatics have still less slope, but here again toluene with a side chain is nearer to the paraffins than the others. The stability of acetylene increases with temperature, in agreement with the observation that small quantities are formed in the electric arc; but the curvature of the line indicates that it never becomes stable with respect to its elements.

The figure shows that relatively high temperatures, 700 to 900° C., are required to make appreciable quantities of aromatics by cracking, and even there the yields are low because there is a greater tendency to form methane and carbon and hydrogen. It is well known that acetylene is never found in appreciable quantities in ordinary cracking operations in agreement with the diagram, which would require a temperature above 800° C.

Because of the difference in slope of the lines for the several olefins, they cross at about 425° C. This means that they tend to polymerize below that temperature, and crack above that temperature. Similarly, the higher olefins tend to isomerize into naphthenes below about the same temperature, and do so in presence of aluminum chloride.

Dissociation

Dissociation of paraffins to hydrogen and olefins with the same number of carbon atoms has been attempted, but without much success because the temperature required, over 700° C., favors more profound disruption of the molecule. The partial removal of hydrogen to form olefins by means of oxygen, sulphur, or other oxidizing agent, although favored thermodynamically, is equally unsuccessful, because the olefin formed is more reactive with the oxidizing agent than the paraffin reagent. Although the

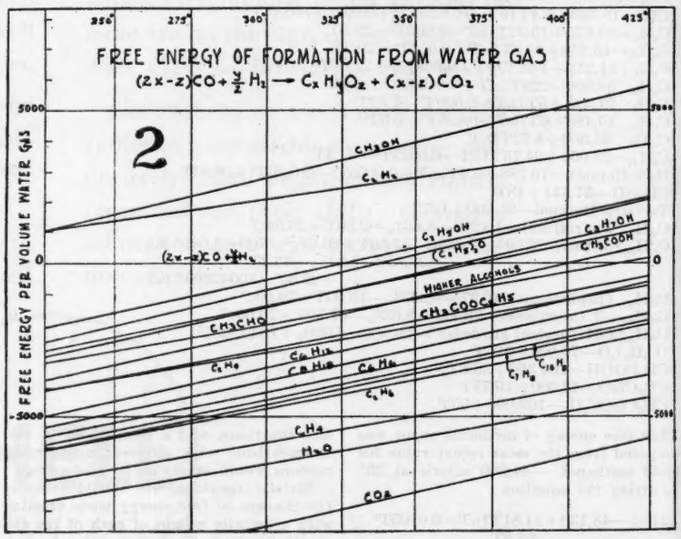

Figure 2—Applications of thermodynamics to chemical reaction of petroleum products.

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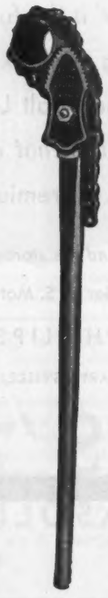

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lines for the paraffins are nearly parallel, and methane is always the lowest, it is possible in some cases to go from a lower to a higher paraffin hydrocarbon by indirect means. Thus, if methane were heated momentarily to about 1,200° C., it would decompose partly to ethylene, acetylene, or aromatics, any of which might be cooled rapidly to about 400° C., at which, with sufficient time, the reaction might proceed further to give ethane or higher paraffin hydrocarbons. This cycle is accomplished substantially by Lind and Bardwell by radiating the lower hydrocarbons with alpha particles, thus providing a nonhomogeneous effective temperature in the system, with repeated sudden heating and cooling. The free energy of the system may be increased by absorption of energy from the alpha particles. But even here there is a net loss of combined carbon and hydrogen, which may result in a net decrease in free energy. In a similar manner, the simple deductions from thermodynamic equations are circumvented by many chemical reactions, merely by taking advantage of the slowness of decomposition of some compounds. Such processes always consume energy, and take place in two or more steps.

New Basis

It was impracticable to include alcohols or other oxygen containing compounds in Figure 1, because their relatively high stability (negative free energy) is due to combination with oxygen, and would give misleading results if plotted on the same basis—free energy of formation per carbon atom. As the main thermodynamic interest in alcohols is in catalytic synthesis, rather than in pure thermal reactions, a new basis has been devised for plotting them, which includes hydrocarbons also.

Computations have been made of the free energies of formation of all the organic compounds from water gas, instead of from the elements. The general equation used has been:

$$(2x - z)CO + \frac{Y}{2} H_2 \rightarrow C_xH_YO_z + (x - z)CO_2$$

where the reactants represent water gas of suitable composition and $C_xH_YO_z$ is any compound of carbon, hydrogen and oxygen. If z is zero, this product is a hydrocarbon.

Again, we are confronted with the problem of the proper basis of comparison. We might divide changes in free energies by the number of molecules of carbon monoxide consumed by the reaction; but when we consider that methane, for example, could be formed by either of the following reactions:

$$2CO + 2H_2 \rightarrow CH_4 + CO_2$$
$$CO + 3H_2 \rightarrow CH_4 + H_2O$$

we see that two molecules of carbon monoxide are consumed in one case and only one in the other, but that four volumes of water gas are consumed in each case. These two reactions proceed concurrently with the same catalyst, and differ only slightly in free energy change. Within certain limits of composition, carbon monoxide and hydrogen in water gas are equivalent, since composition can be adjusted by the "water gas reaction:"

$$CO + H_2O \rightarrow CO_2 + H_2$$

Accordingly, we will reduce the free energies of formation from water gas to "per volume of water gas" consumed. Further justification for this is indicated by the equilibrium constants, which in the above methane reactions are

$$K_1 = \frac{(CH_4)\ (CO)}{(CO)^2\ (H_2)^2} \text{ and } K_2 = \frac{(CH_4)\ (H_2O)}{(CO)\ (H_2)^3}$$

in which both denominators are of the fourth degree in this case. By taking the fourth root of these constants (dividing the free energy change by four, the denominators are reduced to the first degree, and all the equilibrium constants (and free energy changes) are more nearly comparable. Strictly, these equations should not be compared with each other, since the composition of water gas is various for the various reactions. They correspond in each case to the optimum composition of water gas and show, therefore, the greatest decrease in free energy for synthesis of the compound in question.

Equations Simplified

In computing these free energies of formation from water gas, the original equations were first simplified to linear equations over the temperature range 500 — 700° K. (227 — 427° C.), which includes the temperatures of all these synthetic reactions. The reduced results are as follows:

TABLE II

Free Energies of Formation Per Volume of Water Gas

Gas	Free Energy Change
H_2O	— 16,000 + 16.58T
CO_2	— 20,708 + 21.33T
CH_4	— 15,480 + 16.92T
C_2H_2	— 15,567 + 19.0 T
C_2H_4	— 15,935 + 21.17T
C_2H_6	— 12,317 + 16.52T
C_3H_6	— 5,755 + 13.75T
C_3H_8	— 15,540 + 20.16T
C_4H_8	— 16,283 + 20.42T
C_4H_{10}	— 16,155 + 20.47T
C_4H_{10}	— 15,961 + 21.83T
CH_3OH	— 10,346 + 22.9 T
C_2H_5OH	— 12,670 + 21.22T
C_3H_7OH	— 13,714 + 21.44T
Higher alcohols	— 14,595 + 21.65T
$(C_2H_5)_2O$	— 13,833 + 22.66T
CH_3COOH	— 12,390 + 19.28T
CH_3CHO	— 11,523 + 16.52T
$CH_3COOC_2H_5$	— 13,140 + 18.14T

This choice of a basis seems to have been a happy one, since when the values are plotted in Figure 2, all the lines are nearly parallel, i.e., have nearly the same slope regardless of whether the compounds are aliphatic or aromatic hydrocarbons, alcohols, ether, acid, aldehyde, or ester. Even carbon dioxide and steam, formed according to the reactions:

$$2CO \rightarrow C + CO_2$$
$$CO + H_2 \rightarrow C + H_2O$$

have the same slope when plotted on the same basis (divided by two in these cases). The supposition is reasonable that the vapors of all compounds of carbon, hydrogen, and oxygen would have free energies of formation from water gas (whether capable of such direct reaction or not) with a similar slope; and, if so, this will aid greatly in choosing or estimating free energy values.

Figure 2 reveals other interesting relations. With simple catalysts the substances with the lowest lines, carbon dioxide, steam, and methane, are made easily in good yield at atmospheric pressures over a wide range of temperature. The higher hydrocarbons can be made only in low yield, under pressure, with carefully prepared catalysts at a selected temperature, 275° C., which is merely that at which the synthesis of higher hydrocarbons begins, and happens to exceed slightly in rate that of methane.

Methanol

Methanol has the highest line in the figure, and should be the most difficult to make from water gas, contrary to experience, since at high pressure and with the proper catalyst, good yields of methanol are obtainable. This paradox can be partly explained by the fact that, in general, when a system unstable with respect to two or more phases is disturbed, the less stable phase usually appears first. It also indicates the important effect of pressure on the changes in free energy. In syntheses from water gas, the free energies of all the compounds shown in Figure 2 fall below the base line within the temperature range given at a pressure of 1,000 atmospheres. Their relative positions are only slightly altered.

In Figure 2, if by the application of pressure the available free energy of water gas is increased above that of methanol, and the unstable state thus produced is disturbed by a suitable catalyst, the least stable product, methanol, is the first to appear. In the hydraulic analogy, methanol corresponds to a reservoir only slightly below that represented by water gas; but by suitable choice of

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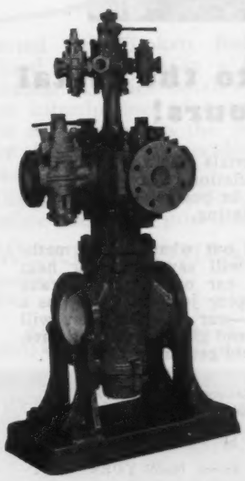

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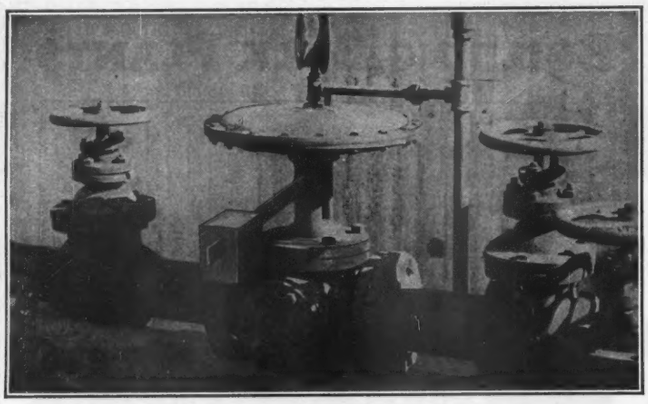

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a catalyst, most of the material can be made to react to this stage only. It is customary to exclude iron from the interior of the catalyst chambers in the methanol synthesis because it has an unfavorable catalytic effect, permitting the formation of hydrocarbons and other oxygenated products, because of too abrupt disturbance of the unstable state of compressed water gas.

Here, again, by carefully controlled conditions, catalyst and temperature, it is possible to skip the methanol line and obtain the higher alcohols, but with a much lower yield and with several products rather than a single one.

Synthol Process

In Fischer's old synthol process, using an iron catalyst, he produced a general disturbance of the unstable state and obtained "the whole aliphatic organic chemistry."

It may be noted that neither acetylene nor any of the aromatics has ever been made by synthesis from water gas, although the former has a line in a position near that of methanol, and the latter have lines close to those of the higher paraffin hydrocarbons. This may be due to the fact that these compounds split up very easily and rapidly into their elements, so that they are unstable with respect to other possible reactions, although stable with respect to water gas, at suitable pressures. At the temperature at which the catalysts are active, the paraffin hydrocarbons are relatively much more stable than aromatics with respect to their elements, carbon and hydrogen.

Only a very tentative beginning has been made on the vast problem of predicting probable reactions of petroleum products from application of free energies. The method is one of great power, and awaits only the systematic collection of the necessary data for computations of high accuracy as a sound basis for development of cracking processes and catalytic syntheses based on petroleum. We venture to predict that the empirical trial and error methods of petroleum chemistry will sooner or later be superseded by research based on well grounded, theoretical predictions—based on an accurate knowledge of the properties of the substances dealt with. The process of obtaining the necessary data is tedious, but the results are certain.

TESTS MADE IN BRIGHT STOCK MANUFACTURE

(Continued from Page 120)

of the sludge produced as quickly as possible. In order to get the best results, some refiners treat their stocks in various percentage solutions of naphthas or kerosenes. There is a large amount of research being conducted along the lines of continuous treating and removing the sludge by centrifuging. This method of treating has great possibilities for more economical treatment and production of a higher grade of acid treated stock.

The amount of free acid remaining in the treated stock can be controlled to a large extent by blowing. The best procedure of doing this is to check the acidity of the treated stock in the laboratory after drawing off the sludge. If the acidity is high, then additional blowing will in most cases reduce it. With additional blowing, the color has to be watched carefully, for it is possible to overblow to the point where oxidation takes place and the color begins to darken. For this reason, it is not practicable to reduce the acidity to a minimum on some batches, as the increased color will more than offset the advantage gained by a slight decrease in acidity.

The stock selected for this experiment was a sample from plant operation, treated with 98 per cent acid in two dumps: The first of 14 pounds and the second of 16 pounds. This gave a sludge loss of 30 per cent and an acid treated stock of 30 color in one-quarter-inch Lovibond cell in 10 per cent solution.

Results of Experiment

In each determination, 1,500 c.c. of acid treated steam refined stock was used, and contacted at 500° F. with 15 pounds of pulp clay per barrel, with results as follows:

	Free acid in acid stock per cent	Color of finished bright stock	Free acid in bright stock per cent
No. 1	0.265	7/8	Neutral
No. 2	0.370	7/16	0.004
No. 3	0.449	9/16	0.004
No. 4	0.582	1/2	0.003
No. 5	0.738	3/8	0.005
No. 6	1.217	1/4	0.009
No. 7	1.575	1/4	0.010
No. 8	1.808	Dark	0.014
No. 9	2.127	Dark	0.023

In experiments on No. 8 and 9, the contacted oil was too dark for testing on the Tag-Robinson colorimeter. No. 8, however, showed a very light green cast. No. 9 was much darker, and was beginning to show a noticeable blue cast.

To determine the effect of additional clay on stocks of the same acidity, another series of determinations was made using 20 pounds of pulp clay per barrel.

	Free acid in acid stock per cent	Color of finished bright stock	Free acid in bright stock per cent
No. 1	0.265	1½	Neutral
No. 2	0.370	1 1/16	Neutral
No. 3	0.449	1 3/16	0.002
No. 4	0.582	1⅛	0.003
No. 5	0.738	¾	0.003
No. 7	1.575	⅝	0.002
No. 8	1.808	5/16	0.007
No. 9	2.127	Dark	0.016

No. 9, like No. 8 and 9 in the first series of determinations, was too dark for testing on the Tag-Robinson colorimeter. The color, however, of No. 9 of this series using 20 pounds per barrel, very closely approximated that of No. 8 of the first series with 15 pounds per barrel.

In the tests, the acidity of the original sample (No. 1) was 0.265 per cent. To obtain the acidity shown in the other samples, the necessary amount of sulphuric acid was added. Upon the addition of acid, there was no change in color, and the determination of free acidity checked the calculated amount added within the limits of error. This check was taken to determine whether or not the acid remained as free acid or reacted with the stock.

Conclusions

Summarizing the above, we believe the following conclusions are justified:

1. There is a direct relationship between the acidity of the acid treated steam refined stock and the color obtained in the finished bright stock. Using a given amount of clay, the color obtained on the finished bright stock is darker as the free acidity of the acid treated steam refined stock increases.

2. The adsorption value of the clay is not 100 per cent selective. It is generally believed that the clay has a selective adsorption for the acid. From the above, it appears that this is true to a limited extent. However, it will be noted from the above that a bright stock of D color, or better, can be produced and still leave a relatively large amount of free acid in the finished bright stock. The acidity of the finished bright stock will vary in proportion to the acidity of the treated steam refined stock.

3. To produce a bright stock which is neutral from a steam refined stock high in acidity, it is necessary to make a much lighter color than may be desired. For example, a neutral bright stock of seven-eighths Tag-Robinson color is desired. If the acid treated steam refined stock contained approximately 0.265 per cent free acid, it could be made with 15 pounds of this pulp clay. Whereas on the other hand, if the stock contained approximately 0.370 per cent free acid, it would require 20 pounds of pulp clay to neutralize completely, with a finished color of 1 1/16.

The above determinations have been conducted using only one kind of clay. However, our experience with several other grades of clay tend to bear out the above conclusions. We have, however, investigated some clays which show high efficiency in neutralizing value but practically no decolorizing properties. In plant operation, the color is approximately 30 per cent better than that obtained in the laboratory.

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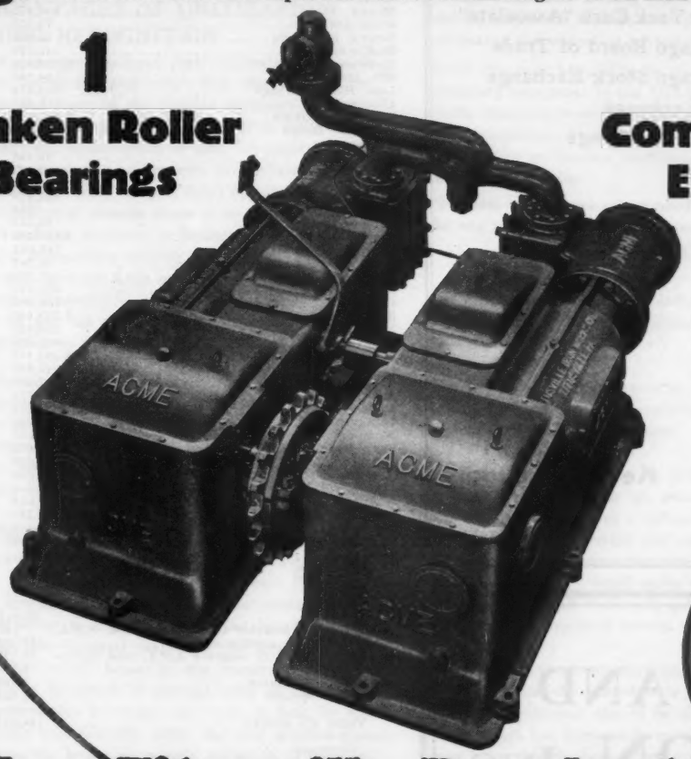

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CALIFORNIA OIL FIELD OPERATIONS FOR OCTOBER, 1929

According to figures collected by the American Petroleum Institute, Pacific Coast office, the total production of crude oil in California for October amounted to 26,895,160 bbls., an average of 867,586 bbls. per day. This is a decrease of 2,556 bbls. per day under September production.

Total stocks of crude and all products in Pacific Coast territory increased during the month 4,659,722 bbls. The total stocks at the end of the month were 184,844,544 bbls. The total stock increase for 1929, up to October 31, was 44,843,650 bbls. Comparative figures as of October 31, 1929, September 30, 1929, and October 31, 1928, are shown.

Fifty-five wells were completed during the month with an initial daily production of 50,563 bbls., compared with 88 wells completed during September with an initial production of 114,991 bbls.

PRODUCTION

(Figures of production and stocks are in barrels of 42 gallons)

District—	Barrels per month	Daily average Oct., 1929	Daily average Sept., 1929	Daily average Oct., 1928
Kern River	570,781	18,412	16,840	11,144
Mount Poso	341,673	11,022	7,154	162
Fruitvale	72,503	2,339	1,885	968
Round Mountain	33,013	1,065	1,139	102
McKittrick	143,825	4,640	4,535	4,865
Midway-Sunset	2,193,832	70,769	68,036	73,449
Elk Hills	534,730	17,249	17,440	20,366
Lost Hills-Belridge	133,679	4,312	4,290	4,070
Coalinga	293,220	9,459	9,570	10,510
Kettleman Hills	312,523	10,081	6,193	161
Wheeler Ridge	20,803	671	662	860
Watsonville	1,938	63	63	62
Santa Maria	93,716	3,023	3,937	5,140
Capitan	2,429	78	.....	.....
Summerland	15,732	507	426	121
Elwood-Goleta	911,720	29,410	20,633	2,463
Santa Barbara	965	31	17	.....
Rincon	88,151	2,844	2,996	4,764
Ventura Avenue	1,889,245	60,943	61,634	54,246
Ventura-Newhall	148,582	4,793	4,974	5,036
Los Angeles-Salt Lake	46,367	1,496	1,492	1,545
Whittier	47,773	1,541	1,530	1,695
Fullerton (Brea Olinda)	419,677	13,538	12,812	15,707
Coyote	324,818	10,478	11,047	13,092
Santa Fe Springs	8,319,641	268,376	280,894	35,967
Montebello	290,420	9,368	9,386	11,114
Richfield	468,625	15,117	15,085	17,025
Huntington Beach	1,294,114	41,746	42,642	51,334
Long Beach	5,045,829	162,769	169,876	193,129
Torrance	417,448	13,466	13,072	16,182
Dominguez	263,232	8,491	8,310	10,320
Rosecrans	229,784	7,412	7,335	5,913
Inglewood	712,309	22,978	22,824	28,003
Newport	930	30	40	42
Seal Beach	1,147,092	37,003	39,625	26,972
Potrero	33,388	1,077	844	280
Lawndale	30,653	989	904	.....
Total October	26,895,160	867,586	870,142	626,806
Total September	26,104,264	870,142	.....	.....
Decrease	790,896*	2,556	.....	.....

*Increase.

STOCKS

	Oct. 31, 1929	Sept. 30, 1929	Oct. stock Increases	Oct. 31, 1928
Heavy Crude, heavier than 20 degrees, A.P.I., including all grades of fuel	112,402,472	110,812,803	1,589,669	98,325,820
Refinable crude, 20 degrees A.P.I., and lighter	42,728,740	40,711,584	2,017,156	17,323,160
Gasoline	16,184,992	15,223,742	961,250	10,626,268
Naphtha distillates	3,506,174	3,287,087	219,087	1,285,014
All other stocks	10,022,166	10,149,606	*127,440	9,763,667
Total all stocks	184,844,544	180,184,822	4,659,722	137,323,929

*Decrease.

DEVELOPMENT

	New rigs up	Active drilling	Completed	Daily initial output	Active producing	Abandoned wells Drillers	Abandoned wells Producers
Kern River	3	5	5	755	1,086	..	..
Mount Poso	7	8	1	241	50	..	..
Fruitvale	...	4	..	.....	8	..	..
Round Mountain	1	1	2	925	8	1	..
McKittrick	...	2	..	.....	280	..	..
Midway-Sunset	11	34	8	4,374	2,153	5	5
Elk Hills	...	1	..	.....	211	..	..
Lost Hills-Belridge	3	5	..	.....	300	..	..
Coalinga	...	4	..	.....	744	..	1
Kettleman Hills	2	29	..	.....	3	..	..
Wheeler Ridge	...	..	..	.....	33	..	..
Watsonville	...	..	..	.....	6	..	..
Santa Maria	...	5	..	.....	205	..	..
Capitan	...	..	1	150	1	..	..
Summerland	2	3	1	150	93	..	..
Elwood-Goleta	4	13	2	9,000	14	..	..
Santa Barbara	...	..	..	.....	2	5	..
Rincon	1	5	..	.....	29	..	..
Ventura Avenue	3	28	2	1,495	185	..	..
Ventura-Newhall	1	18	..	.....	518	..	..
Los Angeles-Salt Lake	...	..	..	.....	314	..	..
Whittier	...	..	..	.....	168	..	..
Fullerton	...	..	..	.....	370	..	..
Coyote	1	1	1	115	203	..	..
Santa Fe Springs	12	179	11	20,001	546	..	..
Montebello	...	2	2	100	176	..	..
Richfield	...	8	3	617	281	..	1
Huntington Beach	1	8	1	160	550	..	1
Long Beach	11	66	12	10,940	997	3	1
Torrance	...	..	..	.....	593	..	4
Dominguez	...	1	..	.....	57	..	..
Rosecrans	1	1	..	.....	103	2	2
Inglewood	...	..	1	225	227	..	1
Newport	...	1	..	.....	3	1	..
Seal Beach	1	5	2	1,315	157	1	..
Potrero	13	15	..	.....	6	1	..
Lawndale	...	..	..	.....	7	5	..
Miscellaneous drilling	17	158	..	.....	..	5	..
Total October	95	610	55	50,563	10,687	29	16
Total September	82	590	88	114,991	10,635	28	11
Increase	13	20	33*	64,428*	52	1	5
Average for year 1928	107	520	59	56,802	10,823	15	25
Average for year 1927	97	404	75	39,992	11,276	23	21
Average for year 1926	95	422	76	32,635	11,288	24	17
Average for year 1925	105	417	79	42,247	11,393	28	12
Average for year 1924	103	510	102	43,412	10,903	28	21

*Decrease.

Excerpts from the report of the Committee on Voluntary Unitization; to the President and General Board of Directors of the Mid-Continent Oil & Gas Association November 26, 1929

The undersigned Committee, appointed by the President of the General Mid-Continent Oil & Gas Association to make a survey of the practice of unit development and operation of oil pools and to submit definite suggestions for furthering the practice, begs leave to report as follows:

ECONOMIC ADVANTAGES OF UNITIZATION GAINING RECOGNITION

The investigations of the Committee disclosed that voluntary unitization had made marked progress during the past year; that nearly all of the major producing companies and many of the smaller operators now recognize its potential benefits including *(a)* saving in number of wells necessary to develop a given area; *(b)* conservation of gas; (c) equitable and efficient utilization of the gas pressure; *(d)* orderly production, and, *(e)* greater ultimate recovery; and, for these reasons, many companies are now active in bringing about unitization of acreage about to be tested. It is generally conceded that the American producer is distinctly at a disadvantage under old time wasteful competitive drilling methods in comparison with the foreign producer who operates large concessions under single or unified ownership and that the necessity for economy and efficiency in development and operation of our oil areas will force an evolutionary change from the former practice to unified control.

It is pointed out, also, that while gratifying results have been obtained from the various curtailment and proration arrangements made and carried on by joint action of the operators and state authorities, these are, after all, only temporary expedients none too stable in character and must be supplemented and eventually supplanted by the more certain and effective stabilizing influence of unit operation.

IMPEDIMENTS TO PROGRESS

In addition to the varied terms and conditions of leases there have been other impediments to the progress of voluntary unitization. Prominent among these has been the attitude of lessors and of some operators with a lack of understanding of what unitization is and the benefits to be derived therefrom; also the time honored custom of the lease broker of selling acreage spreads. The broker, however, has discovered that he can sell undivided interests in his block of acreage with as much ease as he formerly sold separate tracts or leases and that, in fact, he can complete the promotion more expeditiously under the new method than under the old system. As to the lessor or royalty owner, it is believed that he will join the movement in time because unitization will broaden his chance of success by giving him an interest in the entire area, and a greater possible recovery. But it is submitted that it is not indispensable to the success of unitization that the royalty interests be included. Successful unit development may be effected by the working interest, without affecting royalty rights, due care being exercised in the location of wells to prevent drainage or other violation of underlying lease contracts.

In the case of the uninformed operator who opposes unitization because he believes it will interfere with his freedom of operations, it should be pointed out that he may sell or assign his undivided interest in a unitized area with the same facility that he could sell separate leaseholds; that if he is a competent operator there is no reason why he may not be chosen as the operator of unitized areas and thus be enabled to keep his organization busy; and that at all events he will prosper from the improved condition of the industry resulting from stabilization.

CO-OPERATIVE AGREEMENT

In cases where it is not possible to persuade owners of acreage to unitize, much good may be accomplished by means of an agreement for co-operative development and operation. The need for such an agreement frequently arises in trend plays or extensions to known pools. Here the agreement may provide that the initial well in the extension area, designated a key well, shall be held back in production for a stated length of time, usually the length of time required to drill offsets. The consideration supporting this waiver of discovery rights usually consists of undertakings on the part of surrounding owners to contribute to the cost of the well in case it fails to produce. The contract should contain, in all cases, provision for regulating and controlling the production in the interest of conservation.

CODE OF PRACTICE TO SUPPORT AND PROMOTE UNITIZATION

Of vital importance to the unitization movement is the supporting policy on the part of operating companies that they will not purchase spreads of acreage about new drilling projects nor agree to make dry hole contributions unless the acreage is to be unitized or a co-operative plan of development and operation agreed to.

While this may be said to be the policy of an impressive number of oil producing companies in the Mid-Continent Field at the present time, the whole structure is weakened by a tendency on the part of some to recognize exceptions. One exception leads to another and every exception made tends to destroy confidence that there is a serious intention to adhere to the policy.

For these reasons we recommend that no exceptions be made other than the one recognized in the subjoined suggested Rules of Practice.

RULES OF PRACTICE

I.

The oil pool rather than the individual tract or lease is the natural competitive unit in the oil producing business and all future development should be on this basis.

II.

The buying of divided tracts or spreads of acreage as a means of promoting or financing new development projects is inconsistent with and in opposition to unit development.

III.

Agreements to contribute dry hole money to procure tests of new prospective areas constitute an antiquated and deleterious practice unless confined to cases where a co-operative agreement has been made to insure orderly development and production when oil is found. The only permissible exception to this rule is in the case where all the conditions are known and only small wells or pools can be expected to result from the drilling. Small wells are defined as those not capable of producing more than one hundred barrels per well per day.

IV.

The same economic considerations which prohibit the purchase of spreads of acreage and the contribution of dry hole money require also that no new drilling project should be undertaken in checkerboarded areas until every effort has been made to unitize or to effect a co-operative agreement even though there is no occasion or request for purchase of spreads or contributions of dry hole money.

V.

Complete frankness, mutual confidence and trust are essential to success in the unitization movement. It is therefore recommended that the policy be adopted of revealing to each prospective member of a unitized pool the geological information in possession of each participant therein, including the results of core drilling.

VI.

The practice of "top-leasing" is regarded as unethical in the oil producing business. Negotiations by strangers to the title to procure leases to take effect in the future are in derogation of the rights of lessees under valid existing leases in that they force drilling and interfere with efforts to unitize or form co-operative agreements.

VII.

In order to promote the success of the unitization movement by allaying suspicion or refuting rumors as to alleged infractions of the policy against purchase of spreads and contributions of dry hole money, it is suggested that each operator make it an invariable rule to file with a central agency complete reports of exceptions made to Rules II and III, together with the reasons therefor and showing the approval thereof by a chief executive of the company, and that such reports be kept on file and open to inspection by all bona fide operators. The practice of also filing with said agency copies of completed unitization contracts and co-operative agreements for distribution would aid in the educational phase of the movement. The logical agency for this purpose in the Mid-Continent Field is the Mid-Continent Oil & Gas Association and its various divisional offices.

Respectfully submitted,

UNITIZATION COMMITTEE OF THE MID-CONTINENT OIL & GAS ASSOCIATION.

(This space contributed by a member of the Association)

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Products That Cut Down Your Underground Overhead

RESEARCH ON CAUSES OF PIPE LINE CURRENTS

(Continued from Page 254)

presented suggest several possible causes of currents.

As we have pointed out, the observations do not show the characteristics of currents originating in electric railway operation, and the oil lines studied are remote from railway power stations. The fact that the directions of the currents on three lines reverse at the pumping stations is not consistent with the assumption that electric stations are responsible for the currents. The reversals just mentioned and the change in the magnitude of the current with changes in pumping station operation, as shown in Figure 11, indicate that in some cases at least station operation is a factor, but at present the reason for the relationship is not clear.

Currents were found in the Marland line after it had been disconnected from all other structures and parts of it removed from the ground. Our data indicate that, in the case of this line and that of one Standard Oil line, there is a relation between corrosion and discharge of current such as would result if the lines by passing through different soils formed huge galvanic cells. On the other hand, we have found lines passing through soils differing widely in texture, composition, and moisture on which there were no changes in current corresponding to changes in soil.

Bauer has made an extensive study of earth currents. The potential gradients in the earth as reported by him are of the same order of magnitude as those observed along oil lines. Bauer also shows that the earth currents which he describes vary in magnitude from hour to hour, and gradually shift in direction. If a metallic conductor were laid in earth carrying such currents, current would certainly flow on the pipe line also, and it would flow to and from the line as the line passed through soil formations of different electrical conductivities. But the reversals of the direction of pipe line currents at pumping stations can hardly be accounted for by earth current phenomena; nor can the differences in characteristics of the pipe gradients shown in Figures 6, 7, and 8 be so explained.

Figures 6, 7, and 8 show newly laid lines anodic to older parallel lines, indicating that a galvanic cell is formed when a new line is interconnected with an old one.

R. C. Wells has suggested that electric currents may result from the oxidation and reduction of ore deposits. Such currents, if found on pipe lines, should not fluctuate; and the direction of flow along the line should be determined by the positions of the ore deposits.

From the knowledge of the phenomena of pipe line currents that we now possess, we must conclude either that the cause of the currents is unknown or that they arise from several causes, and that the current found on any line may be the resultant or summation of currents from several sources.

Practical Significance of Data

Reviewing the data presented, we find that in two instances there appears to be a rather close relation between discharge of current and corrosion. Other cases have been found where no such relation was apparent. The latter cases may be explained by assuming that not all corrosion is accompanied by the flow of current over sufficient distances to permit its measurement by the methods employed; and that, where discharge of current was found without corrosion, either the discharge had not continued long enough to produce noticeable corrosion, or that corrosion may have existed unobserved.

If we assume that the current is the result of chemical action of soil solutions on the pipe, we know that the action can be reduced by preventing the current flow, since the anode of a galvanic cell corrodes only slowly, if at all, when the cell is on open circuit. If we assume that the currents do not originate at the surface of the pipe line, but are the result of pumping operations, earth potentials or galvanic cells independent of the line, then the ordinary laws of electrolysis should hold.

In either case, reduction of the current on the line will reduce the corrosion associated with or caused by the current.

Examination of the data will show that the current on a single line is small, the maximum observed current being less than 5 amperes. The total current flowing to or from a pumping station may, however, be of considerable magnitude. The importance of pipe line currents has not been determined with sufficient definiteness to justify any considerable expense in their elimination; but in so far as they can be reduced without appreciable additional expense, that reduction seems advisable. The means of reducing the currents are two: Reduction of the conductivity of lines by the use of high resistance metal and insulating joints, and the surface insulation of the line by nonconducting protective coatings.

COMBATING CORROSION IN CRUDE OIL REFINING

(Continued from Page 150)

porosity, a detrimental factor of this process unless heavy coatings are applied. Heavier coatings, of course, consume considerable time in their application.

Lead coating by this method was also tried on the underside of an agitator roof but failure occurred in four months, due largely to thin coating and porosity.

Failures were also noted on inside of pressure vessels which had been aluminum coated.

Whitewash and Concrete

Under certain conditions whitewash has proven quite efficient in retarding corrosion of pressure vessels but it must be renewed continually. Concrete is also a practical coating for the inside of such vessels.

Calorized tubes in a test in an oil cracking still gave good service but in every case were equaled simultaneously by plain carbon steel tubes in the same unit. Calorizing protects the outside of the tube against oxidation but unfortunately the inside coating is removed in a very short time by the turbine cleaner.

Baked or vitreous enamels are useful in small units but their use is handicapped by the fact that they cannot be applied in the field and the vessel or apparatus so protected must be treated as a unit.

Paints and lacquers come in for a large share of protection against corrosion particularly in atmospheric service. One paint is being used quite successfully in protecting the underside of steel tank roofs where considerable corrosion is encountered.

Breather valve screens are affected by corrosion and they become clogged and useless. To overcome this difficulty various metals were tested as well as coatings including gold plated wire cloth. Tin coated brass was found to be the most practical and economical and after its period of usefulness has passed it is discarded.

Pumps handling sour naphthas present several difficulties in addition to corrosion. The nature of the stocks has a destroying action on any packing lubricants and the packing has to be kept tight to prevent leakage, thus inducing severe wear on pump rods. Nitrided pump rods were tried in this service and became badly scored in a comparatively short time and after 37 days had to be removed.

Cleanliness Essential

In applying protective coatings regardless of their kind, absolute cleanliness is essential and field applications of paints and metallic coatings are preceded by sand blasting to present a clean surface and afford better bond.

Cadmium coating is being used quite extensively of late and has merit in resisting atmospheric corrosion. However, it is of little value in an oil refinery

The oil industry has taken on a new lease of life.

It is getting away from its 70-year-old policy of ruinous overproduction and over-refining.

The industry in the United States realizes that it is dealing with a commodity that once gone cannot be replaced—a one crop commodity, as it has often aptly been called. Therefore, it has started a policy of conservation.

The industry is trying for stabilization; to make supply conform as closely to demand as the peculiar character of the commodity will permit.

The movement has the support of all the large oil companies and many of the smaller companies and individuals in California, Texas, Oklahoma and Kansas. The State governments of California, Texas and Oklahoma are back of this new oil policy with laws and Corporation Commission orders. The Federal Oil Conservation Board is in sympathy with it.

Fields are being prorated. Surplus production is being kept in its natural storehouse. Gas is being conserved to an extent never dreamed of in past years. Unit operation in exploration and in development is being attempted on a large scale.

Refiners, who are the purchasers of crude oil, are in sympathy with a policy which will stabilize the price of crude so that they can plan their manufacturing and marketing more than 24 hours ahead.

All the regional oil associations are favorable to the new order of things. It is to bring this vital matter before the large body of unorganized oil men that this advertisement is presented.

The conservation movement will have practically 100 per cent support if all oil men will acquaint themselves of the merits of the plan, which has for its end the conservation of our petroleum resources, and by means of this, the general good of the petroleum industry and the nation at large.

Contributed to the cause of Unit Development by a Mid-Continent oil company.

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The OIL and GAS JOURNAL

where a few hours' exposure to the fume laden atmosphere causes discoloration followed by complete failure.

In the selection of materials caution must be used in accepting the statements of those exploiting the articles. Cases of misrepresentation occur more often through lack of knowledge regarding the product and service conditions rather than deliberate attempts to mislead. In every case claims of exceptional merit are proven by tests where the article must demonstrate its value.

The metal is yet to be found, if at all, that will answer all the corrosion problems. There is no cure-all, but the art of alloying various metals is progressing rapidly and great strides are being made in combating corrosion by the use of alloys for specific service conditions.

Many materials are being offered to the consumer that are designed for certain conditions and their increasing number in turn demands more tests to find the most efficient. To illustrate this, brief reference is made to some of the tests being made to convey an idea of the scope of this field of research.

Long Time Test

To obtain some indication of corrosion effect on different metals a long time corrosion test is being conducted containing specimens of 108 different materials placed at 10 locations as representative of refinery conditions.

In testing small diameter thin walled tubes for condenser and heat exchanger service, miniature units were constructed and operate in parallel with regular refinery equipment. This work involves more than 25 different materials and will extend over a period of years.

Screw plugs for cracking stills were kept under observation for more than four years and included a great many materials, finally producing one that is giving good service.

In a paper of this kind only general reference can be made to many items that have to be studied, and I have tried to convey the fact that corrosion is of tremendous importance in economical refinery operation and a subject involving considerable research, test work and study.

SOME PROPERTIES OF MID-CONTINENT CRUDE

(Continued from Page 154)

obtained from Figure 4 (mol per cent versus weight per cent) which is an integral curve of Figure 3. Its use is illustrated by the following example. A distillate is obtained representing 20 to 40 per cent off of the crude. From the plot, the total mols distilled up to 20 per cent gives 0.196 and up to 40 per cent as 0.324 mols. Then the molecular weight is

$$\frac{40-20}{.324-.196}=156.$$

This curve loses its accuracy beyond 70 per cent, but fortunately Figure 3 gives nearly linear relationship beyond 50 per cent so the molecular weight can be obtained by its use and the mean weight per cent of the cut. A volume per cent-weight per cent plot is incorporated in Figure 4, so this plot may be of use when percentage is expressed on a volume basis.

The relationship between total volume per cent distillate and molecular weight and volume per cent bottoms and molecular weight, shown in Figures 5 and 6 were obtained from Figure 4, and are of interest as showing the change in total molecular weights as distillation proceeds.

Figure 7 shows the relationship between Saybolt Universal viscosity at 100° F. and molecular weight. Figure 8 shows the relationship between absolute viscosity at 100° F. and molecular weight.

Figure 9 shows the relationship between total volume per cent distillate and bottoms and specific gravity.

Other combinations, useful for some purposes, could be shown, but it is believed that the data presented here are sufficient to enable those desiring such other combinations to prepare plots.

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TULSA, OKLAHOMA

The Byrne Stationary Ventilator. Note the size of the weather guard and its sturdy construction.

EASTERN FIELDS

(Continued from Page 148)

Peters Township, W. A. Lindsay, trustee, completed in the same formation a second test on the Jesse Woods farm. It is a small gasser.

In Greene Township, Greene County, the Peoples Natural Gas Co.'s No. 3 on the John Lantz farm is a gasser in the Elizabeth sand at a total depth of 3,162 feet. In Richhill Township, B. L. Fry has a duster in all sands at No. 9 on the W. J. Bryan farm.

At Duff City, Allegheny County, David Neely & Co. completed a duster on the M. Pfaff farm. In the same locality, M. M. Walley completed in the 100-foot sand a test on the Simon Plegar farm. It is an 8-bbl. pumper. In Smith district, Washington County, Kaufman & Armor have a duster on the D. McPeak farm. In Hanover Township, Beaver County, George Armor has a light pumper on the George Armor farm. In North Strabane Township, Washington County, E. H. and J. B. Tague completed No. 7 on the R. G. Lutton farm. It is a 15-bbl. pumper. In Franklin Township, Westmoreland County, the T. W. Phillips Gas & Oil Co. completed a gasser in the Bradford sand on the S. Yeager farm.

In Greene Township, Beaver County, the Ramsey Oil Corp. completed No. 15 on the Ramsey farm. It is a light gasser. In south Beaver Township, Beaver County, J. L. Abrams has a duster on the Kennedy farm.

NO MAJOR CHANGES ON THE EAST COAST

(Continued from Page 215)

78,285 bbls., compared with 582,000 bbls., or 83,142 bbls. daily in the preceding week and 88,107 bbls. for the four weeks ended November 23. Details follow:

At Atlantic Coast Ports—	Bbls. of 42 Gls.
Boston	95,000
New York	325,000
Philadelphia	80,000
Others	48,000
Total	548,000
Daily average	78,285
At Gulf Coast Ports—	
All ports	None
At Atlantic and Gulf Coast Ports—	
Total	548,000
Daily average	78,285
Daily average 4 weeks	84,071

Distribution of total California oil receipts is as follows:

Gasoline	440,000
Gas oil	64,000
Fuel oil	12,000
Kerosene distillate	32,000

CONTROL OF VACUUM BY SIMPLE APPARATUS

(Continued from Page 211)

ing from slightly less than atmospheric down to 1 cm. of mercury.

A slight adjustment of the degree of opening of the stopcock C is required for different pressures. This is accomplished by moving the relay about the screw H until the proper position with respect to the stopcock is found and then securing it in position by means of the screw I. The bore of the stopcock should be small, 1 mm. or less, so that only a slight movement entirely opens or closes it.

NEW MEMBERS OF COMMITTEE

NEW YORK, Dec. 2.—Appointment of two new members to the general committee on corrosion was announced today by the American Petroleum Institute: Park W. Daw, of the Shell Oil Co., San Francisco, and J. E. Biggins, of the Gulf Refining Co., Port Arthur, Tex. Mr. Daw succeeds E. O. Bennett, of the Continental Oil Co., and Mr. Biggins Dr. H. F. Perkins, of the Gulf Refining Co.

SHELL PIPE LINE STATEMENT

The Shell Pipe Line Corp.'s report for October shows pipe line runs of 3,729,788.63 bbls. ,a daily average of 120,315 bbls.; shipments, 4,164,217.93 bbls., a daily average of 134,440 bbls.

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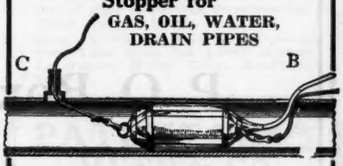

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The OIL and GAS JOURNAL
TULSA, OKLA.

THE PETROLEUM INDUSTRY'S REGARD FOR THE WELFARE OF ITS WORKERS WAS AGAIN DEMONSTRATED BY THE UNANIMOUS ENDORSEMENT OF THE ASSOCIATION'S SAFETY ACTIVITY BY THE BOARD OF DIRECTORS OF THE GENERAL MID-CONTINENT OIL & GAS ASSOCIATION AT ITS ANNUAL MEETING, TUESDAY, NOVEMBER 26th, 1929.

SAFETY SECTION
OF THE
MID-CONTINENT OIL & GAS
ASSOCIATION

(This space contributed by a member of the Association)

Oklahoma-Kansas and Eastern Pipe Line Report

OKLAHOMA-KANSAS PIPE LINE STATEMENT FOR SEPTEMBER

Runs

	Month	Dy. av.
Prairie P. L. Co.*	5,100,000	170,000
Gulf P. L. Co.	2,146,322	71,544
Texas P. L. Co.	779,039	25,968
Magnolia P. L.	1,967,530	65,584
Empire P. L. Co.	1,704,033	56,801
Cosden P. L.	841,285	28,043
Sinclair P. L. Co.*	3,066,000	102,200
Oklahoma P. L. Co.	3,361,011	112,034
Other lines*	6,217,500	207,250
Total September	25,182,720	839,424
Total August	26,253,728	846,894
Difference	1,070,998	7,470

Shipments

	Month	Dy. av.
Prairie P. L. Co.†	6,552,482	218,416
Gulf P. L. Co.	1,899,684	63,323
Texas P. L. Co.	1,251,480	41,716
Magnolia P. L. Co.	2,198,026	73,268
Empire P. L. Co.	1,481,630	49,388
Cosden P. L. Co.	827,229	27,574
Sinclair P. L. Co.†	3,320,879	110,696
Oklahoma P. L. Co.	3,250,403	108,347
Other lines*	6,300,000	210,000
Total September	27,081,813	902,728
Total August	28,695,007	926,645
Difference	1,613,194	22,917

Stocks

Prairie O. & G. Co.	37,600,000
Gulf P. L. and Gypsy Oil	10,237,633
The Texas Company	7,969,471
Magnolia Petroleum Co.	9,423,863
Empire P. L. Co.	5,219,647
Mid-Continent Pet. Co.	3,319,513
Sinclair Crude Oil Pur. Co.	20,340,000
Carter Oil Co.	10,089,103
Oklahoma Pipe Line Co.	2,443,543
Other crude stocks*	27,000,000
Total September	134,642,776
Total August	134,563,144
Difference	79,632

*Estimated. †Prairie and Sinclair shipments include crude oil produced in Texas.

EASTERN PIPE LINE REPORTS

Runs From Wells

In the following table will be found the regular receipts from wells by various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky and Indiana for September and October:

	Sept., 1929	Oct., 1929
Nat. Transit	294,748.89	404,122.07
S. W. Pa. P. L.	89,643.06	94,485.54
Eureka P. L.	357,703.92	407,367.33
Buckeye P. L. (Macksb'g.)	331,438.55	368,647.98
Buckeye P. L. (Cleve.)	10,770.51	12,971.28
Buckeye P. L. (Lima, etc.)	103,534.37	111,929.62
Indiana P. L.	5,270.40	5,168.79
Cum'land P. L.	188,201.35	197,918.75
N. Y. Transit	30,538.20	32,746.64
Tidewater P. L.	59,187.70	.....
Pure Oil	240,830.38	290,221.77
Paragon Dev.	13,427.85	13,725.53
Stoll Oil Ref.	4,827.82	5,077.57
Bradford Tran.	289,323.57	414,513.56
Total	2,019,446.57	2,358,896.43
Daily average	67,314.88	76,093.43

Note—Indian Refining Co. also reported other receipts of 467,659.27 bbls. Paragon Refining Co. has other receipts of 189,418.26 bbls. Paragon Development had other receipts of 585.74 bbls.

Petroleum Deliveries

The following tables exhibit the shipments or regular deliveries of various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky for September and October:

	Sept., 1929	Oct., 1929
Nat. Transit	502,982.89	601,799.57
S. W. Pa. P. L.	364,433.46	332,869.58
Eureka P. L.	230,056.08	228,566.66
Buckeye P. L. (Macksb'g.)	234,242.65	196,645.46
Buckeye P. L. (Cleve.)	2,182.54	2,185.51
Buckeye P. L. (Lima, etc.)	1,632,220.66	1,676,756.01
Indiana P. L.	1,379,905.31	1,425,999.12
Cum'land P. L.	208,727.10	178,996.97
Southern P. L.	92,625.44	64,066.81
N. Y. Transit	279,908.63	292,940.39
Northern P. L.	168,857.71	168,667.97
Tidewater P. L.	211,086.95	280,269.87
Pure Oil	248,121.86	290,992.65
Paragon Ref.	170,090.96	175,750.89
Paragon Dev.	12,326.20	15,869.35
Bradford Tran.	308,652.35	.....
Total	6,036,420.79	5,932,376.81
Daily average	201,214.02	191,366.99

Indian Refining Co. reported other deliveries of 426,148.84 bbls.

Gross Stocks

The gross stocks held by various pipe lines in the oil producing sections of New York, Pennsylvania, West Virginia, Ohio, Indiana and Kentucky and Indiana at the close of September and October:

	Sept., 1929	Oct., 1929
Nat. Transit	654,825.92	719,388.96
S. W. Pa. P. L.	556,527.00	498,919.11
Eureka P. L.	1,415,789.95	1,398,117.80
Buckeye P. L. (Macksb'g.)	394,708.80	400,582.44
Buckeye P. L. (Cleve.)	56,858.66	48,885.71
Buckeye P. L. (Lima, etc.)	2,860,912.26	2,783,005.84
Indiana P. L.	575,104.02	747,719.04
Cum'land P. L.	539,326.53	562,259.60
Southern P. L.	387,726.89	339,742.96
N. Y. Transit	167,745.27	142,410.37
Northern P. L.	365,819.17	328,077.84
Tidewater P. L.	955,021.33	909,010.27
Pure Oil	15,318.69	20,118.60
Paragon Ref.	10,799.07	24,163.27
Indian Ref.	141,337.05	182,679.26
Paragon Dev.	6,461.28	4,903.36
Tuscarora	265,097.04	266,678.11
Bradford Trans.	73,688.01	65,438.84
Total	9,443,066.95	9,441,101.38
Increase	2,424.36	
Decrease		1,965.57

Grades of Oil

The following table shows the amount of the different grades of oil held by the Eastern Pipe Lines at the close of September and October showing the gross stocks of the above fields:

	Sept., 1929	Oct., 1929
Penn'a.	3,341,064.05	3,372,038.77
Lima	574,215.23	563,216.33
Kentucky	713,582.53	711,964.81
Mid-Continent	4,519,636.67	4,494,811.77
Illinois	294,569.47	299,569.70
Total	9,443,066.95	9,441,101.38

Daily Average Runs

The following table shows the daily average runs of the Pennsylvania, Lima and Kentucky oil fields for the past four years:

	1926	1927	1928	1929
January	55,630	56,209	52,904	51,749
February	60,394	61,298	57,002	51,833
March	61,644	63,247	57,485	54,252
April	63,019	60,927	56,812	53,444
May	60,580	60,284	62,067	59,902
June	61,121	62,767	58,230	58,833
July	63,206	58,674	57,144	56,087
August	61,815	60,870	57,745	56,687
September	64,639	60,285	53,487	67,315
October	161,132	147,080	58,100	76,093
November	67,774	57,275	53,565	.....
December	58,755	53,089	52,025	.....

Daily Average Shipments

The following table gives daily average shipments from the Pennsylvania, Lima and other fields for the past four years:

	1926	1927	1928	1929
January	156,056	141,227	146,465	165,721
February	169,488	138,534	167,368	159,387
March	150,239	133,777	158,883	161,474
April	152,374	140,227	172,935	169,737
May	160,998	144,594	180,559	184,281
June	160,267	149,772	188,024	185,404
July	160,045	151,850	189,470	194,763
August	151,929	188,653	192,853	184,946
September	158,915	144,212	194,138	201,214
October	161,132	147,036	176,000	191,367
November	172,608	150,975	176,898	.....
December	136,428	144,504	173,572	.....

Gross Stocks

In the following table will be found the gross stocks of the various lines of the Pennsylvania, Lima and Kentucky oil fields, including oil received from other lines at the close of each month for the past three years:

	1927	1928	1929
January	9,718,008	12,276,710	7,596,564
February	10,119,162	12,180,419	8,738,835
March	10,794,044	12,239,725	9,002,058
April	11,112,295	11,740,125	8,978,172
May	11,359,381	11,602,468	8,903,560
June	11,493,673	11,287,678	8,921,275
July	11,458,128	10,819,331	9,211,595
August	11,989,115	10,236,743	9,440,643
September	12,212,716	9,660,910	9,443,067
October	12,047,661	9,229,709	9,441,101
November	11,939,740	8,366,553	.....
December	12,340,297	7,539,555	.....

Franklin Pipe Co.

The following table exhibits the condition of the Franklin Pipe Line at the close of business for the months named and not counted in the stocks and averages reported above:

1928—	Runs	Shipments	Stocks
October	1,289.93	538.89	17,551.93
November	2,663.53	788.47	19,426.99
December	3,053.60	3,167.53	19,426.99
1929—			
January	2,099.90	.....	19,313.06
February	2,469.47	6,873.20	17,009.23
March	3,330.82	3,595.01	16,745.04
April	4,864.07	4,243.59	17,365.52
May	2,688.59	2,455.54	17,598.57
July	2,947.62	3,329.35	4,503.48
August	2,742.73	2,889.47	4,356.74
September	2,925.71	2,897.34	4,385.11
October	3,083.59	1,754.94	5,713.76

The Illinois Field

The following table gives the report of the Illinois Pipe Line Co. in Illinois:

Gross stocks, November 1	2,416,864.80
Runs from wells	593,307.69
Other receipts	360,730.14
Regular deliveries	482,983.75
Other deliveries	346,458.23

The amount of Illinois oil run by the Tide Water Pipe Co. in October was 28,995.14 bbls. Deliveries were 75,574.93 bbls. Adding these figures to those of the Illinois Pipe Line Co. makes the runs and deliveries as follows:

1928—	Runs	Deliveries
November	576,332.88	702,589.93
December	584,633.00	491,517.26
1929—		
January	570,727.38	545,084.66
February	517,330.17	503,387.70
March	728,319.67	586,049.60
April	515,374.27	654,297.96
May	608,981.60	673,812.83
June	568,454.70	818,845.97
July	611,106.79	828,159.44
August	635,351.99	746,425.06
September	582,457.86	669,947.72
October	622,302.83	558,558.68

Tide Water Pipe Co., Ltd., also delivered in September 268,016.93 bbls. Oklahoma oil.

AVERAGE DAILY RECEIPTS OF CALIFORNIA OIL AT ATLANTIC AND GULF COAST PORTS

Average bbls per day—	ATLANTIC PORTS Baltimore	Boston	New York	Philadelphia	Others	Total	GULF COAST PORTS Galveston	New Orleans Baton Rouge	Port Arthur Sabine Pass	Tampa	Total	Total all ports
February	14,214	.....	38,750	17,250	11,607	81,821	.....	.....	.....	.....	3,750	85,571
March	19,902	968	21,258	15,581	7,355	78,065	.....	.....	.....	.....	.....	78,065
April	16,667	.....	23,333	13,333	2,334	64,667	.....	.....	.....	.....	7,333	65,200
May	14,226	2,416	21,326	10,806	2,129	62,903	.....	.....	.....	.....	.....	62,903
June	14,866	2,167	23,100	10,300	6,100	57,533	.....	.....	.....	.....	.....	57,533
July	15,387	4,806	24,290	19,388	2,452	76,323	.....	.....	.....	.....	4,161	80,484
August	20,389	2,129	35,226	18,903	5,548	82,194	.....	.....	.....	.....	12,161	95,355
September	19,433	.....	31,834	11,900	6,200	69,367	.....	.....	.....	.....	4,800	74,167
October	9,065	4,677	42,065	12,000	9,677	77,484	.....	.....	.....	.....	4,097	81,581

AVERAGE DAILY IMPORTS OF PETROLEUM AT PRINCIPAL UNITED STATES PORTS

Average bbls per day—	ATLANTIC PORTS Baltimore	Boston	New York	Philadelphia	Others	Total	GULF COAST PORTS Galveston	New Orleans Baton Rouge	Port Arthur Sabine Pass	Tampa	Total	Total all ports
February	13,750	15,071	125,179	32,750	17,893	214,643	.....	34,357	321	143	35,321	249,964
March	18,548	26,064	146,516	39,162	28,163	257,453	.....	42,581	2,323	.....	44,903	302,355
April	19,733	15,367	137,233	50,367	22,567	245,267	6,667	25,066	10,367	1,500	43,600	291,967
May	29,806	19,258	138,000	49,936	22,323	259,322	6,677	25,322	3,000	1,323	37,323	296,645
June	31,433	8,667	134,600	42,967	18,300	235,967	3,600	22,633	11,800	3,033	45,066	281,033
July	40,097	15,129	111,677	48,430	21,516	241,839	4,774	12,097	9,516	161	26,548	268,387
August	33,387	14,355	162,644	30,936	20,355	261,677	4,226	12,743	.....	1,484	18,453	280,129
September	32,967	9,000	136,633	54,300	32,900	265,800	6,900	32,900	5,367	1,333	36,500	302,300
October	39,936	10,519	137,096	38,160	38,644	264,355	6,613	13,388	11,064	4,419	35,484	299,839

GROSS PRODUCTION IN THE UNITED STATES FOR 12 MONTHS (REVISED)

(In Barrels of 42 gallons)

1928-29		California	Oklahoma	Texas	Kansas	Arkansas	Louisiana	Rocky Mts.	Eastern	Total
October:	Month	19,430,992	23,431,071	22,176,852	3,058,460	2,652,484	1,826,221	2,571,822	2,612,000	78,759,903
	Daily average	626,806	755,841	715,376	98,660	85,564	59,233	82,962	116,516	2,540,964
November:	Month	19,907,526	22,078,630	20,791,795	2,977,800	2,476,020	1,801,914	2,383,570	2,348,000	75,770,665
	Daily average	663,584	735,954	693,059	99,260	82,534	60,064	79,519	111,800	2,525,689
December:	Month	21,574,703	22,425,732	22,180,103	2,958,400	2,531,571	1,846,841	2,389,040	2,581,000	79,407,379
	Daily average	695,958	723,410	715,487	95,400	81,341	59,576	77,840	115,518	2,561,528
January:	Month	23,385,939	22,575,874	23,412,226	3,861,641	2,453,526	1,807,887	2,076,070	3,439,000	82,012,163
	Daily average	754,385	728,254	755,232	92,311	79,146	58,318	66,970	110,936	2,646,554
February:	Month	22,200,707	20,464,164	20,816,309	3,557,968	2,154,194	1,569,930	1,965,656	3,113,000	74,941,328
	Daily average	796,454	730,863	743,434	91,356	76,936	56,068	70,202	111,184	2,676,473
March:	Month	24,324,729	20,838,262	24,358,592	2,951,076	2,303,724	1,766,153	2,195,332	3,586,000	82,314,359
	Daily average	784,669	672,202	785,761	95,196	74,314	56,650	70,838	115,677	2,655,302
April:	Month	23,295,060	20,236,290	23,493,097	3,112,740	2,188,680	1,703,479	2,085,030	3,524,000	79,636,376
	Daily average	776,502	674,543	783,103	103,758	72,956	56,750	69,501	117,467	2,654,546
May:	Month	24,053,351	21,345,453	24,489,101	3,665,099	2,300,153	1,713,261	2,252,522	3,879,000	83,617,945
	Daily average	775,915	688,563	789,965	118,229	74,618	55,267	72,662	126,129	2,697,353
June:	Month	24,624,627	20,661,113	24,698,029	3,636,150	2,112,270	1,699,581	2,180,752	3,887,000	83,399,521
	Daily average	830,831	688,371	823,267	121,205	70,337	56,653	72,692	129,567	2,779,984
July:	Month	26,796,627	22,371,326	26,969,980	3,867,157	2,137,947	1,716,488	2,360,836	4,439,200	90,659,739
	Daily average	864,407	721,675	869,997	124,747	68,937	55,370	76,156	143,200	2,924,489
August:	Month	27,332,253	22,439,492	27,490,489	3,816,555	2,036,023	1,764,973	2,478,016	4,340,000	91,638,961
	Daily average	876,495	723,532	886,757	123,115	67,293	56,934	79,936	140,000	2,956,092
September:	Month	26,104,264	21,402,390	25,987,102	3,780,690	1,969,730	1,718,250	2,346,480	4,200,000	87,498,896
	Daily average	870,142	713,413	866,236	126,023	65,324	57,275	78,234	140,000	2,916,647
	Total 12 months	283,031,878	266,159,435	286,863,557	39,273,736	27,265,537	20,933,978	27,190,917	44,943,000	939,867,968

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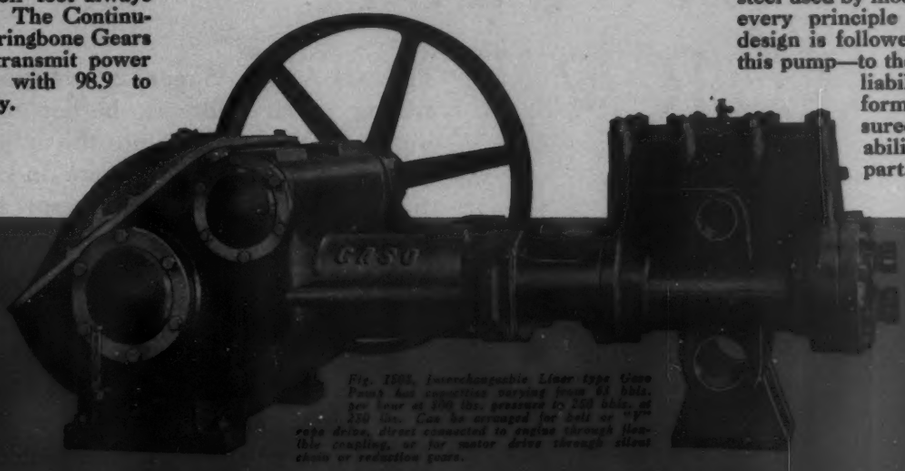

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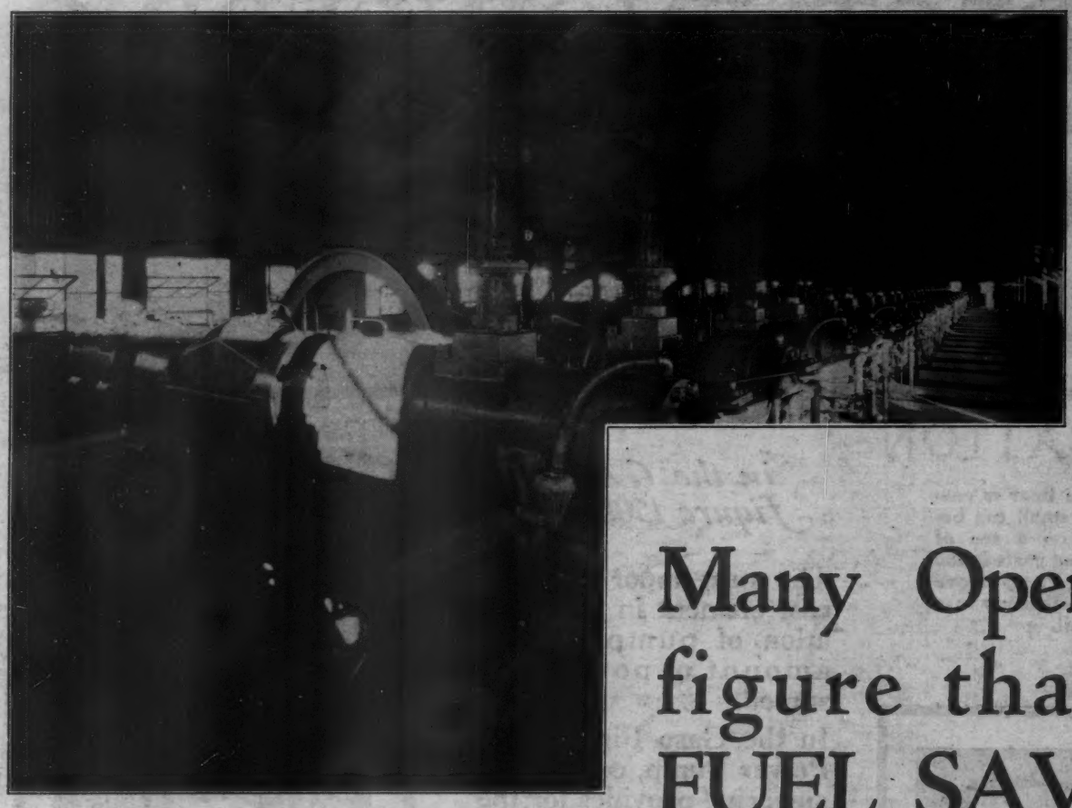

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